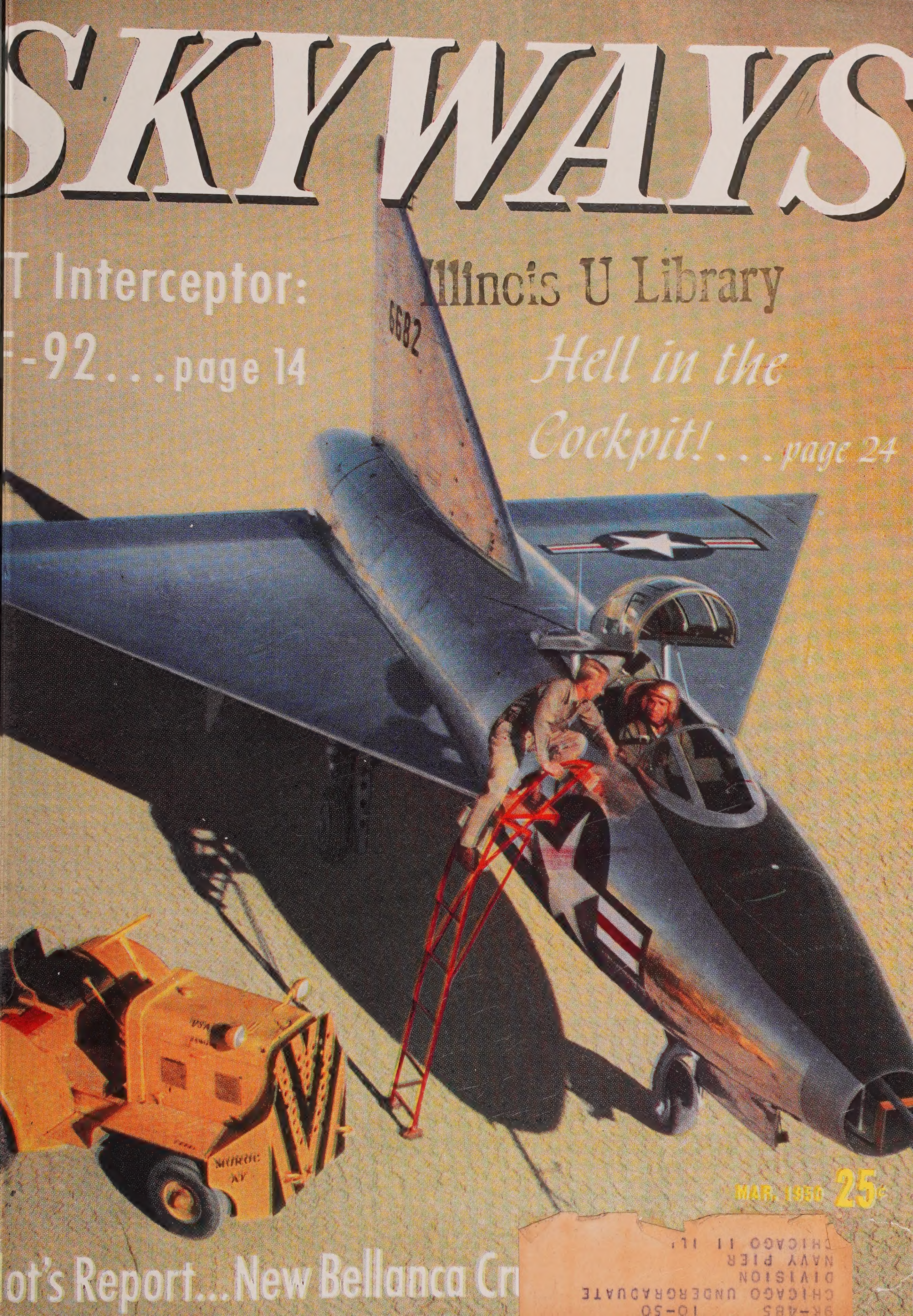

SKYWAYS
T Interceptor:
F-92...page 14
Hell in the Cockpit!...page 24
MAR. 1950 25¢
ot's Report...New Bellanca Cr
MUROC AF

The Birdmen's Perch

Plane efficiency—*plane efficiency!* As long as it remains one of the vital ingredients in lightplane flying, those words will always sound like a soft sigh from Lana Turner.

The late Bill Odom proved the importance of *plane efficiency* on his record-breaking lightplane flight from Honolulu to Teterboro, N. J.

Pre-flight studies supplied Bill with all kinds of important data and you can bet, before taking off he checked everything as carefully as a chorus girl ogling a new mink coat.

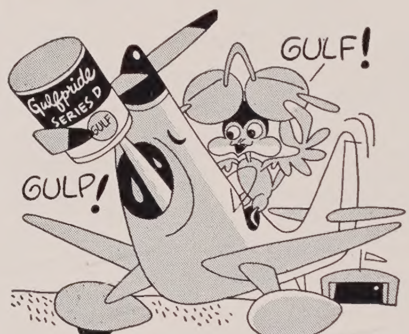
Of course, Bill was using the data to establish maximum range cruising conditions, but the same info can be used to give the best setting for maximum endurance, maximum speed for a specified fuel supply, and so on.

Yep—whether you're going to hop the continent or just take in the bathing beauties at the beach, it will pay you (in more efficient and economical operation) to spend a few hours pre-flighting your ship to discover the *facts!*

AND, BY JEEPERS . . .

Speaking of economical, efficient operation, if you're one of those guys who needs an overhaul job every time you fly down to the corner grocery, Gulfpride Aviation Oil—Series D—is the answer!

It's the world's finest detergent dispersant oil for horizontally opposed engines—the only aviation oil put through Gulf's exclusive Alchlor process to remove extra carbon and sludge formers.



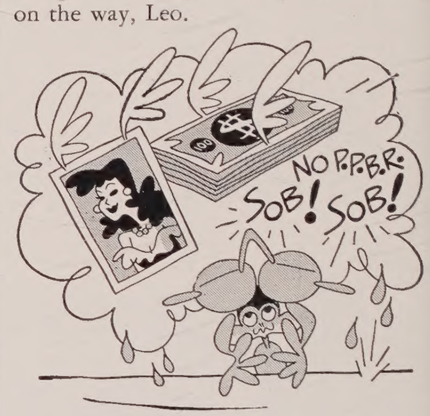
Gulfpride Aviation Oil—Series D—will increase the periods between overhauls up to 100% by keeping valves and rings free *longer!*

LITTLE KNOWN FACTS DEPT.

So you're sitting there minding your own business when a big tycoon from Cincy comes looking for a zoot pilot to fly him and his beautiful daughter to Bermuda.

You can smell that "long green," the daughter is a gorgeous hunk of stuff, everything's rosy when—whammy! "Where's your Perch Pilot's license?" he says.

So—you haven't got one! Too bad, but the affluent gentleman can contact United Airlines Captain Leo Kriloff of Burlingame, Cal. His L.K.F. (with proof) entitles him to the honorable Commission of Perch Pilot (br)—that's "Bottom Rung" in Ubangi. Your Commission's on the way, Leo.



Leo says: "*Believe it or not, United Air Lines' Valley Queen, between Los Angeles and San Francisco, makes better time with a headwind. That's because all airfields between the cities are laid out north and south. With a headwind there's no need to waste time circling for a landing!*"

Don't remain unsung forever. Send your Little Known Fact About Well Known Planes—with proof—to this address:

GULF AVIATION DEPT., GULF BUILDING
PITTSBURGH 30, PA.

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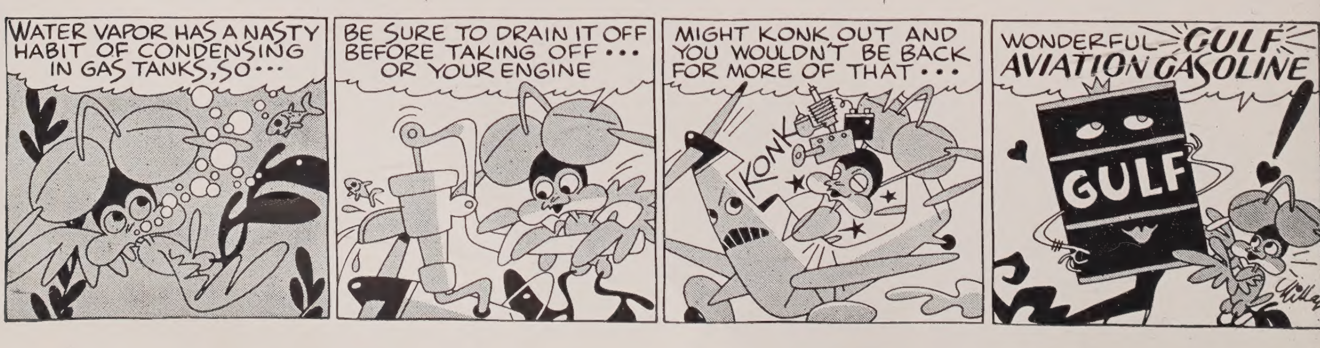

Coming Up...

in SKYWAYS

In many parts of the country, now is the time to really get working on those winter dreams of flights to here and there just for the fun of it. The time is now, that is, if you can banish the lethargy that rides with ye olde fashioned spring fever. Take your copy of SKYWAYS with you, read the pilot-authored articles and compare another airman's methods with yours.

Here's the line-up for April:

- **"So You Want to Set a Record,"** *by Capt. Norman Marsh, USMCR.* What pilot hasn't thought of breaking a lightplane record of one sort or another? This pilot gave it some thought, then decided to try it. He did . . . three times, and the record he came up with, plus how he did it, makes for good pilot reading and fun.

- **"Pilot's Report:** Cosmic Wind," *by Fish Salmon.* The author of this article has flown everything from jet jobs to midget racers. In this piece he gives you the word on flying those small "home-built" racers that pour around the pylons at Cleveland and Miami every year. Put yourself in the cockpit with Fish Salmon and get to know firsthand the rights and the wrongs in midget racer flying.

- **"Hell-Bent for Rescue,"** *by Terry Kay.* Not long ago a B-29 went down in the Atlantic. Days went by before the doomed bomber's crew was rescued. The story of that rescue and the flying boys who made it is told in this one.

- **"Sky-High Sabre Dance,"** *by George Welch, as told to Don Downie.* The jet F-86 is one of the Air Force's top fighters. Project Pilot Welch recounts the development of the mighty *Sabre* and how it handles in high-speed maneuvers.

- **"Test Pilot Training,"** *by Lt. Hank Searls, USN.* Test pilots are made not born. In this article, Lt. Searls takes us to test pilot school and through it, where life is study, more study and saw-tooth climbs in everything from flying boats to jet jobs.

These are just a few of the features for the pilot and plane owner who makes sure he gets SKYWAYS

April Issue

SKYWAYS

Cover: Consolidated-Vultee XF-92A

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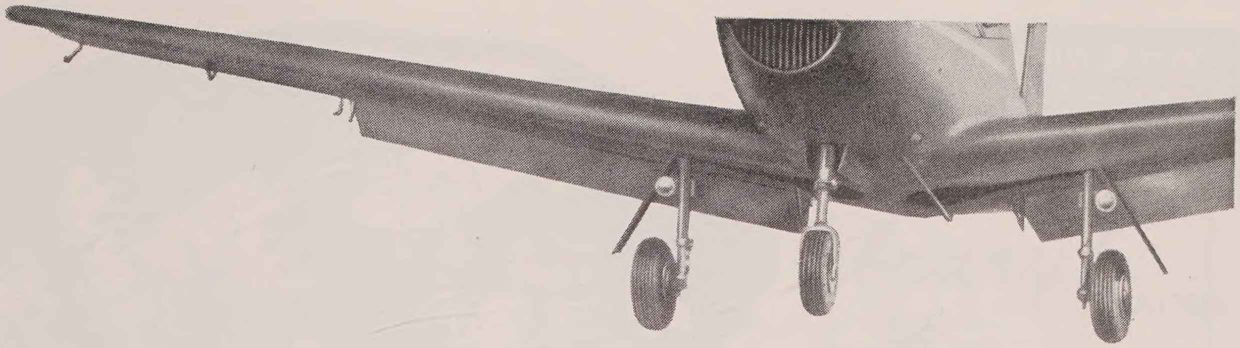


Coming — 3 new Ryan Navions for 1950

(and prices begin at $9485)

Utility Navion 205

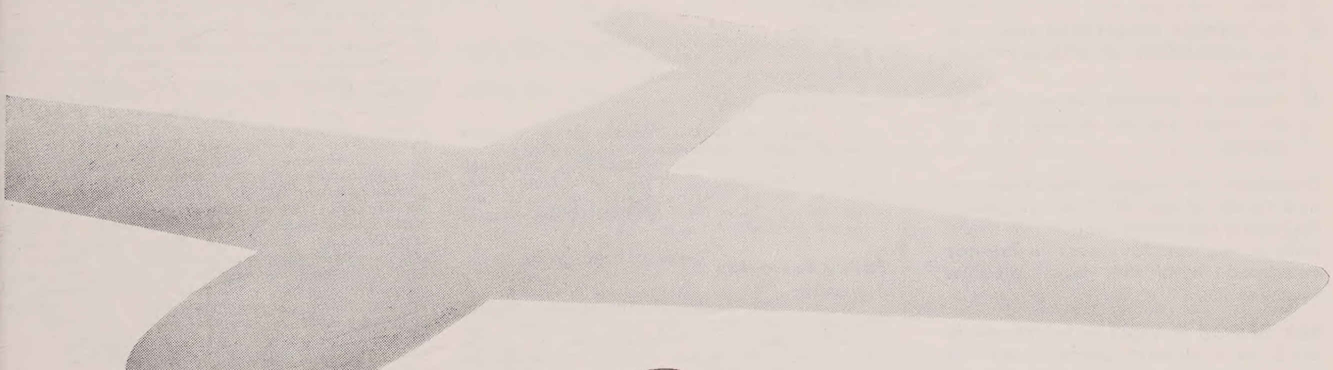
A new, hard-working Ryan plane for all who need modern, safe air transportation at minimum cost. Ideal for heavy-duty chores where deluxe appointments are not necessary. Retains *all* features which make *Navion* so easy-to-fly safely.

DeLuxe Navion 205

Four years of service testing; four years of refinements; four years of improved production techniques are embodied in the new DeLuxe *Navion* 205! New features, beauty and comfort...*plus* proven *Navion* safety and ease-of-flying.

Super Navion 260

Lycoming-powered, the new 260 h.p. Super *Navion* cruises at 170 m.p.h. . . . gives superlative performance without sacrificing the safe, easy-flying characteristics . . . the rugged short-field performance for which *Navion* is justly famous.



Ryan Navion

No other plane combines so many features so well

WANT MORE DETAILS on any, or all, of the three new *Navion's*? A request today on your business letterhead will bring complete information.

RYAN AERONAUTICAL COMPANY, 203 LINDBERGH FIELD, SAN DIEGO 12, CALIF.

AIR YOUR VIEWS

Cessna 195

Gentlemen:

I read with interest your article on the Cessna 195. In the text Mr. Arentz states the 12 experimental models purchased by the Air Force were standard production models. I take this to mean they were powered by Jacobs 300-hp engines. Yet, later the article states the USAF Cessna's were powered by 450-hp *Wasp* engines. I'd be willing to bet there is not a Pratt & Whitney 450 under the cowling of a Cessna 195. Please set me straight.

EUGENE B. MORRIS

Sandusky, Ohio.

You are right, Mr. Morris. Information received in this office regarding the Air Force 195's first came through with the P & W 450 info. Later this was changed, but it was too late to make corrections in the article. Our apologies to Cessna and to the Jacobs engine, 300-hp, which powers all Cessna 195's be they Air Force or Civilian owned.—ED.

Hughes Enterprises

Gentlemen:

Has Howard Hughes' flying boat ever been flown other than on that first test flight?

Also, did the four-place all-metal *Atlas* with retractable landing gear and controllable pitch prop ever get into production?

LeROY YOUNG

Muskegon, Michigan

According to the very limited amount of information we can gather, Howard Hughes' flying boat has not flown since that first test hop. In fact a great deal of secrecy today surrounds that airplane. We've been told it is under constant guard and no one gets near it. As far as our records show, the Atlas *never did go into production. The company that developed the ship, Atlas Aircraft Company of Hemet, California, is said to be still active. However, we do not believe anything has been done with the four-place all-metal* Atlas *in the way of production or marketing.*—ED.

Jane's

Gentlemen:

Could you give me some information regarding a book called "Jane's Aircraft?" Where can I buy it and how much will it cost?

R. KEIL

Spring Valley, N. Y.

Full title of the book is "Jane's All the World's Aircraft." Latest edition is 1949-1950. The edition for U.S. distribution was published by Whittlesey House, McGraw-Hill Book Co., Inc., New York, N.Y. The volume sells for $16.75 and can be ordered through your local book dealer or directly from the publishing house.—ED.

Pappy Boyington

Gentlemen:

Please inform reader M. Hayden of Clinton, Mississippi, that Pappy Boyington apparently has deserted the airlanes for the airwaves. He can be seen on television in Los Angeles refereeing the wrestling matches. He is almost as colorful as a referee as he was a pilot, and can really give those 200-pounders the old heave-ho.

N. WELLS

Los Angeles, Calif.

Too Little . . . Too Late

Gentlemen:

Being an admirer of SKYWAYS magazine since its inception and always looking forward to its arrival each month, I was sorely grieved to read the editorial in your January, 1950, issue.

Your editor, as such, is in a position to do civil aviation much harm by publishing that apparently harmless, well-intended editorial. Civil aviation to my knowledge has two important organs that reach the flying public; yours being one of them. Your Mr. Henry should remember he is an editor first, an airman secondly.

His suggestion that private aircraft be restricted from metropolitan airports is an answer to the air traffic-congestion problem, but not a practical nor fair one. It brings to mind one of the courses that was seriously proposed to halt a plague epidemic during the Middle Ages. The idea was to kill off people in great numbers, be they well or sick, in order to reduce the amount of disease. Sure, it would have worked, but who wants that sort of remedy?

By what stretch of the imagination is it claimed that the numerically few executive planes are more vital to American business than the thousands of aircraft utilized for both business and pleasure?

I've talked with CAA (non-Washington variety) in the lower echelons, and all I've talked to don't tend to over-simplify, but they face the issue realistically. They say it's merely a matter of education. After all, the situation is not so bad that we didn't break all records in air travel safety . . . something like 1.4 fatalities per 100 million passengers isn't bad at all!

When the CAA can't even interpret its own regulations, I think it's time for a clean-up. I've posed several questions to inspectors and I've come up with as many answers as inspectors. Tain't right.

Clear cut flying regs, hard-boiled air cops . . . and gradual improvement is the answer. As Capt. Eddie Rickenbacker stated recently at an ATA meeting, "Accidents are the price we pay for motion."

WILLIAM WIESE

San Diego, California

SKYWAYS does not propose to close all fields used by commercial airliners to private planes. It is our belief that in cities as large as New York and Washington, private pilots should have their own good airports to operate in and out of, airports that are geared to handle private planes and that have facilities designed for the private pilot. The type of airport we proposed to close to private-plane operation are only those that already have shown their displeasure in having to handle private-plane traffic by offering little if any service for the private pilot and then charging large landing fees on top of that. The private pilot and his plane is of vital importance to all of us. The private pilot is the fellow who fought and won the air war in World War II. He is important to us . . . so important that we think he should have his own airport, one that is as close to the metropolitan district as the airline terminal is. Most private pilots we've talked to don't want to operate out of fields where airline traffic is heavy. We like your letter, Mr. Wiese, and we think you've stated your case well. We also believe it's time for a clean up in CAR's. Actually, we want the same things . . . safety and safeguards for private flying, commercial flying and military flying. In short . . . we want safety in aviation for all.—ED.

J-47 or J-35

Gentlemen:

In your January issue you state one place that the J-35 jet engine is more powerful than the J-47; in another place you say the '47 is more powerful. Which?

J. OERLEY

Walla Walla, Wash.

Until very recently, the J-47 jet unit was more powerful than the J-35. Recently, however, the thrust of the J-35 was substantially increased (in newest version), so that this latest J-35 is said to be more powerful than the '47.—ED.

SKYWAYS
SKYWAYS

FLIGHT TESTING of the new 12-placo Sikorsky helicopter was completed successfully recently by the Air Force. Feature of the new 'copter is accessibility of working parts

MILITARY AVIATION

MIT WIND TUNNEL, the largest at any university for research on problems of high-speed flight, was recently dedicated. Called the Naval Supersonic Laboratory, the tunnel was built under the auspices of the Navy Bureau of Ordnance, and is designed to provide speeds ranging up to 3,000 mph.

AIR FORCE has appointed an Air Force Academy Site Board to study reports on various sites considered for location of newly planned Air Force Academy. Gen. Carl "Tooey" Spaatz heads the committee.

U. S. NAVY is selling its two 180-passenger Lockheed *Constitutions* to commercial interests. Reason for having to sell is the budget cut which does not permit the Navy sufficient funds to operate the *Constitutions.*

NORTH AMERICAN AVIATION is building a research station for testing and evaluating rocket motors and their components for use in guided missiles. The huge laboratory is located in the Santa Susana mountains near Los Angeles.

PRODUCTION CONTRACT from U.S. Air Force has been awarded Lear, Inc., for autopilots and gyro indicating instruments. The Lear autopilot is designated as the F-5 and has been a personal project of Bill Lear's since early 1945. This autopilot is scheduled for installation in the Northrop F-89 *Scorpion.* The F-5 will: a) maintain the aircraft in a straight-and-level flight on a magnetic heading, b) permit climbs and/or dives of plus or minus 20° from level flight, and c) permit coordinated turns up to a maximum bank angle of 40°.

USAF AIRCRAFT PROCUREMENT for 1950 presents a drastically reduced picture of air power. Here are the reductions (from President Truman's budget for 48-group Air Force to same budget after Defense Secretary Johnson's cut): Grumman SA-16, cut from 30 to 11; Lockheed TF-80, cut from 110 to 80; North American T-28, from 125 to 85; Convair T-29, from 39 to 12; Fairchild T-31, from 199 to none; North American F-86, from 300 to 250; Northrop F-89, from 38 to 27; Lockheed F-94, from 178 to 125; Convair B-36, from 51 to 47; Boeing B-47, still 75; Fairchild C-119, from 69 to 53; Douglas C-124A, from 54 to 36; Chase C-122, from 25 to none. This reduction amounts to over 38 per cent. Apropos of this reported cut in expenditures, consider Secretary Johnson's address to a group in New York recently in which he decried "penny-pinching" national defense in the face of existing international conditions!

MORE CUTS came to the already depleted Air Navy forces. Following orders issued by Defense Secretary Johnson, the Navy has had to reduce its combat air strength by 20 per cent. The Navy will decommission 470 out of a total strength of 2,258 combat planes. Four attack groups will be eliminated as well as five patrol squadrons and seven Marine fighter squadrons. The Navy is now scheduled to operate only eight attack carriers in 1951.

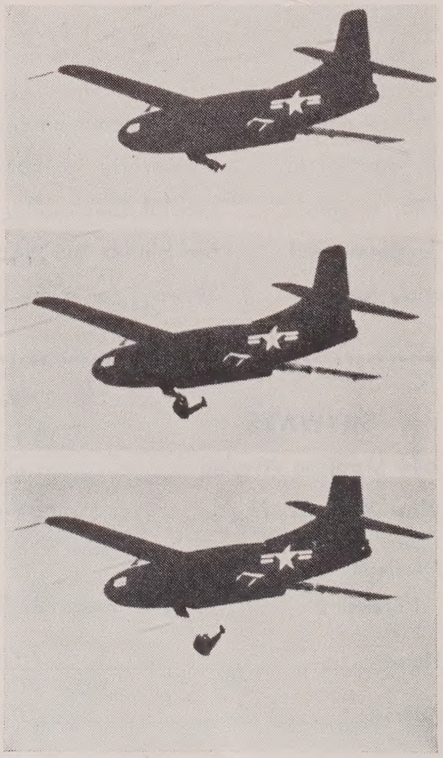
FLIGHT TESTS are being run on a new Cessna designed for Air Force liaison work. The new plane is a single-engine high-wing all-metal ship that appears to be a development of the popular Cessna 170.

FIFTY PILOTS and 150 ground crewmen of the Air National Guard are completing tarsitional training for F-84 *Thunderjet* operations. The six-weeks course was given at Shaw Air Force Base, South Carolina.

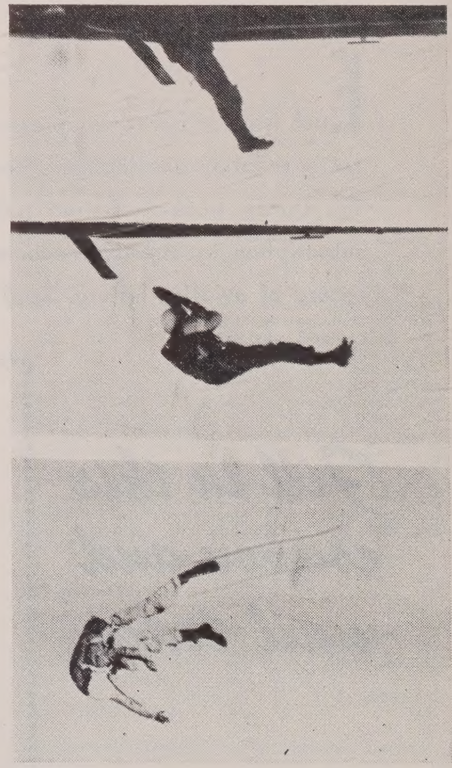
AIR FORCE is studying the crosswind landing gear developed by the CAA. An engineering analysis of the DC-3 equipped with the gear is being made at Wright Field Base in Dayton.

NEW SABRE recently completed its first flight tests. This one is designated the YF-86D. Designed to climb quickly to extreme altitudes for interceptor missions, the *Sabre* is powered by GE J-47 jet engine equipped with an afterburner which increases engine thrust. Main difference between this version of the *Sabre* and its record-holding predecessor is that new YF-86D has an intake duct under the nose instead of in the center.

MACKAY TROPHY was presented to Lt. Col. Emil G. Beaudry of Manchester, N.H., by Gen. Hoyt S. Vandenberg, Air Force Chief of Staff. Col. Beaudry was the pilot of the plane which rescued 12 fellow airmen marooned on a Greenland Icecap a year ago last December.



NEW EMERGENCY EXIT to clear pilot out of fast-moving jet was tested recently by AF



CLOSE-UP of pilot escape shows him dropping out of a hatch in the airplane's belly

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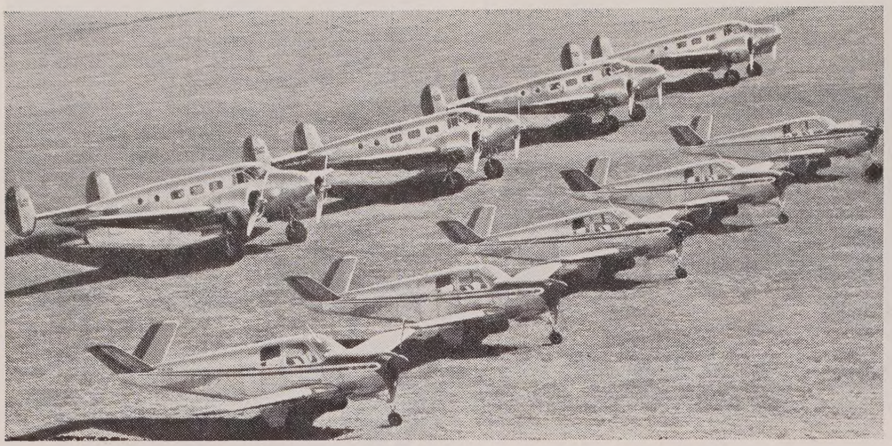


BEECHCRAFTS, four Twins and five *Bonanzas*, are lined up awaiting delivery to Brazil

HANGAR FLYING

Modern Age Paul Revere

Here's a story sworn to be true: an aircraft buyer for one of the nation's leading airlines went to England to see S.B.A.C.'s Air Display at Farnborough, which featured Britain's jet development along commercial aircraft lines. When our airline man returned to New York, he arranged a four-way phone conversation between himself and the Chief Engineers of three of the leading aircraft companies. When all three Chief Engineers were finally on the line, Mister Airline Executive curtly called out, "The British are coming!" and hung up!

Champion for 1950

Aeronca Aircraft has announced its first of the 1950 line of lightplanes. This one is the 90-hp deluxe *Champion*. New features include complete 12-volt electrical system, soundproofing, full-width rear seat, No-bounce gear, leading edge landing lights, navigation lights, cabin heater. As standard equipment the 1950 two-place *Champion* is equipped with right wing auxiliary gas tank providing 18.5 gallons of fuel. Optional is a 5-gallon left-wing fuel tank.

Lightplane Skis

Federal Aircraft Works has just brought out a new wheel-ski combination for lightplanes that has been under development for some time. This new combination permits take-offs and landings on either bare runways or deep snow. This combination ski unit is attached to the landing gear of a lightplane and operates in conjunction with the plane's wheels. A pilot control in the cockpit either hydraulically or electrically raises and lowers the ski position of the gear. This type of gear has been in use on such aircraft as C-47's, C-82's, P2V-2's, etc., for some time, but this is its first application to the lightplane.

Another Navion

Ryan Aeronautical has still another model to add to its 1950 line of *Navions*. Called "Utility 205," this *Navion* is powered by the same 205-hp Continental and offers the same performance of the Deluxe model. Only difference is that the "Utility 205's" interior furnishings and instruments are less elaborate than in the deluxe model. Ryan now offers *Navions* from $9,485 to $13,985. The Deluxe *Navion* sells for $10,985, the Super 260 for $13,985, and the 205 for $9,485.

Pilots' 10 Commandments

Here's a new set offered by *Oregon Air News*, published by the Oregon State Board of Aeronautics:

1. Thou shalt not become airborne without checking fuel supply.
2. Thou shalt not taxi with carelessness.
3. Thou shalt ever take heed unto air traffic rules.
4. Thou shalt not make flat turns.
5. Thou shalt maintain thy speed lest the earth rise up and smite thee.
6. Thou shalt not let thy confidence exceed thy ability.
7. Thou shalt make use of thy carburetor heat.
8. Thou shalt not perform aerobatics at low altitudes.
9. Thou shalt not allow indecision in thy judgment.
10. Thou shalt know always: the good pilot is the safe pilot.

New Jane's All The World's Aircraft

Those pilots who are building an aviation library will want the new 1949-1950 Jane's, one of the most complete books on world aviation that's published. An acknowledged authoritative source, Jane's includes photos and complete specifications on all aircraft from 24 countries, including Russia. Gas turbine engines and piston engines of all countries are also an important part of Jane's. This volume is one of the most worthwhile additions to an aviation library that we know of. Published in this country by Whittlesey House, the new Jane's sells for $16.75.

Ground Speed Check

Oklahoma's Aviation Commission offers this quickie method of checking your ground speed:

1. Note time over a check point.
2. At the end of any number of minutes evenly divisible into 60 (5, 6, 10, 12, 15), mark your new position on your chart.
3. Measure the miles traveled.
4. Multiply this distance by the number of times your chosen time interval (#2) goes into 60.

The answer is your ground speed. For example, six minutes is one-tenth of an hour. Your plane flies 11 miles in this time, and 10 times 11 equals 110 mph ground speed.

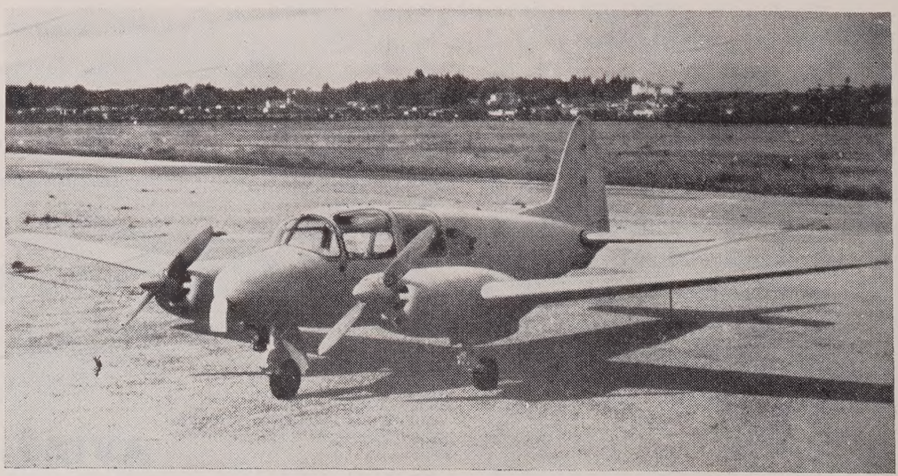
Stewart Airport

Flyers planning trips via West Virginia, Parkersburg, that is, will go for the Sky-tel at Stewart Airport. Operated for motorists as well as air travelers, the Sky-tel has 15 rooms each one with private bath, that rent for $4.50 to $6 a night. There is also Hertz-Rent-A-Car service available, and taxi or bus service. For your plane, there is either hangar space or tie-down. Note Stewart Airport on your chart, and stop in for service for plane or pilot.

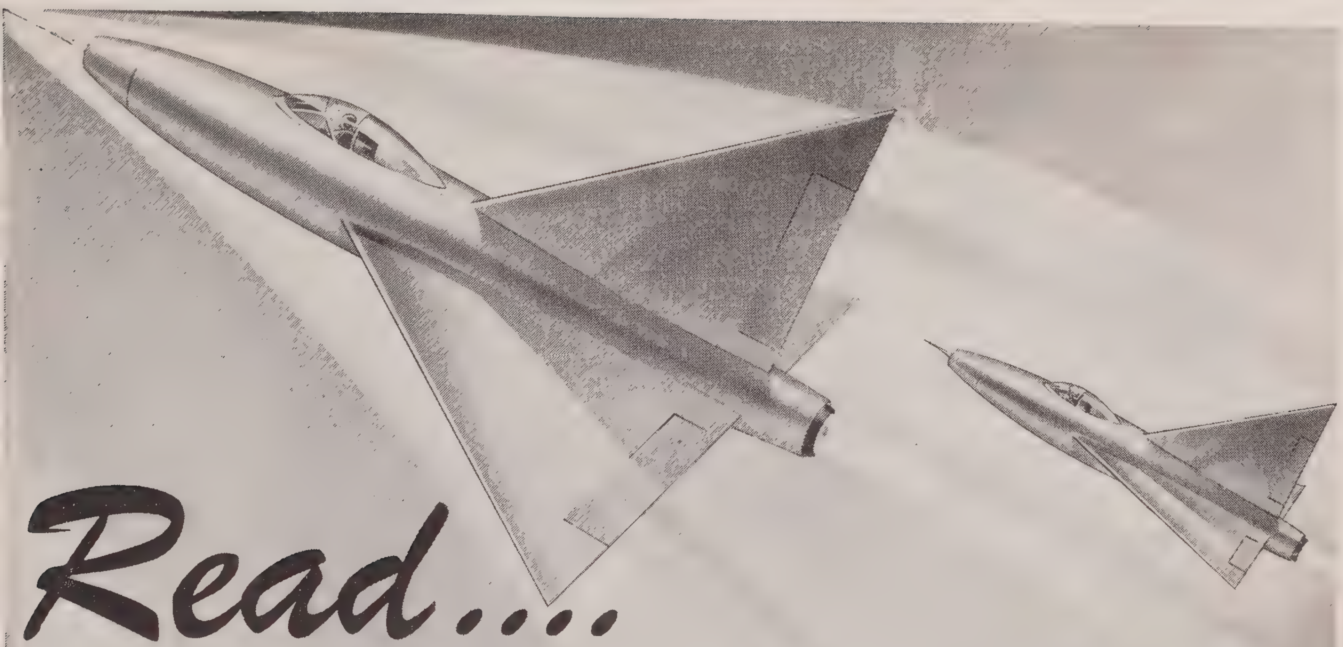
Wing Tips

Shell Oil Company has a booklet out that's free for the asking. It's a combination Directory of Shell airport dealers and a Digest of state laws affecting tax on aviation fuels. Pilots will find it handy.

New British lightplane is the Chrislea *Skyjeep*, a single-engined aerial runabout especially designed for export. Powered by 155-hp Blackburn *Cirrus Major* engine, the *Skyjeep* has a top speed of 130 mph and cruises at 110 mph. It has a range of about 530 miles, and will sell for a little over 2,000 pounds (about $5600).



ITALIAN M.B.320 is six-place plane powered by 185-hp engines; has 180-mph cruising speed



Read....

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RICHARD A. SMITH, (Cal-Aero '43)

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ADDRESS

CITY AGE

HIGH SCHOOL ATTENDED ZONE STATE

Check one ☐ Veteran ☐ Non Veteran GRADUATED, YES ☐ NO ☐

S-3

PROP WASH

Aero Oddities

Strange Pip. Controller sat watching radar screen as two *Corsairs* practiced simulated instrument landings. The two *Corsairs* showed up as pips on the radar screen. Suddenly, a third pip showed up on the screen. The controller noted its erratic flight path and decided someone was having trouble. Just as he was about to alert crash crews, he recognized the strange pattern of the third pip. It was, in reality, a student pilot from a nearby field practicing Lazy Eights. (*D. A Krupp, Philadelphia, Pa.*)

Last Jump. Gunner in a B-24 fell asleep en route back to home base after long mission. On landing at base, pilot rang warning bell informing crew switches were off and boys could leave the ship. Bell woke the sleeping gunner with a start, lack of engine noise threw him a mental block. He snapped on chest chute, dove out camera hatch. Neither concrete apron nor gunner's head were seriously damaged. (*D. Mullins. Chicago, Ill.*)

How? When B-26 *Invader* landed at Eglin AFB after trip from California, mechanics found a live Mallard inside engine cowling. It had zipped through plane's prop that was revolving 16 times per second. Instead of being chopped into duckburgers, the bird suffered loss of few feathers, bent beak. Duck was released after three days, promptly sped away unassisted. (*C. Markey, Chillicothe, Mo.*)

Lucky Stop. Pilot and friend went for plane ride early one evening. Power failure forced pilot to make emergency landing in farmer's field. The friend discovered they'd landed at relative's farm, so boys stayed for dinner, fixed engine, took off again for home base with plane laden with fruits, vegetables from farm. (*B. Mertes, Chicago, Ill.*)

Moo Method. While on last leg of X-C, pilot became lost in heavy overcast. After flying around aimlessly trying to decide what to do, pilot spotted faint maze of lights through the fog. Flying toward it, he discovered lights were on a blimp enroute to mooring station on his home field. The pilot swung in behind "Flying Cow," followed it to safe landing at airport. (*H. H. Haddad, Wickford, R. I.*)

Reet Beep. Pilot took an elderly relative for her first flight. Just after touching down in a tail low landing in a Cessna 170 was equipped with stall warning buzzer, the pilot was asked by his passenger, "My goodness, you even have a horn to warn other airplanes that you are coming!" (*H. Opel, Seattle, Washington.*)

How High Is Up? Lost on a night mission during a rainstorm and his plane running out of gas, pilot decided to abandon ship. He bailed out of advanced trainer and landed in densely wooded section, his chute snagging on a tree and suspending him in mid-air. Unable to climb shroud lines, pilot dropped articles out of his pocket to see if he could judge how far up from the ground he was. Sound, however, was deadened by rain-soaked leaves. Pilot hung there until next morning when daylight revealed he was a mere four feet above terra firma. (*R. L. Nicholas, Irving, Texas.*)

Att'n Readers:

If you have any news note oddities pertaining to aviation, send them to SKYWAYS, Box 17, 444 Madison Avenue, New York 22, N. Y. Five dollars will be paid the sender of each "oddity" printed. Contributions cannot be refunded unless accompanied by stamped addressed envelope. The decision of the editors is final.

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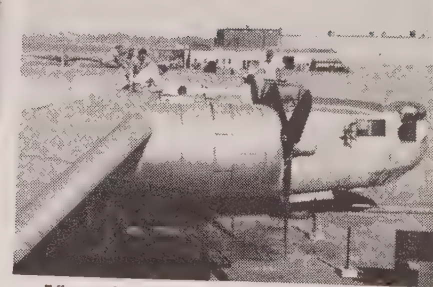

Many "live" aircraft, from single-seaters to large multi-engine planes, give Northrop students first-hand knowledge of aircraft construction and power-plant installation.

Running a strain test on magnesium alloy, these students are using the famous Tinius Olsen machine capable of exerting 60,000 pounds of force. There are many other modern precision devices in NAI "Test Lab."

In a huddle on their design for the rudder on a student project aircraft, these Northrop students study their assembly drawings, a scene they will repeat many times in their careers.

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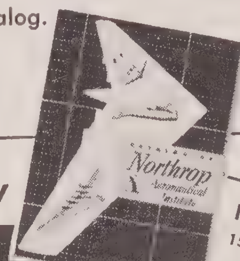

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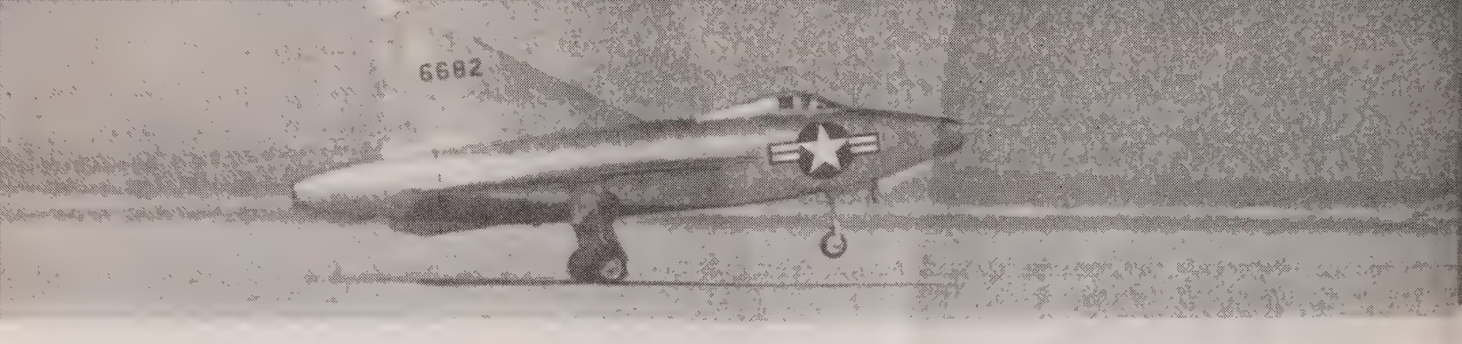


UNUSUAL FACTOR in flying the XF-92A, reports Test Pilot Sam Shannon, is its high angle of attack in take-off and landing

By DON DOWNIE

AT THE turn of this century, the power play of football was the "flying wedge."

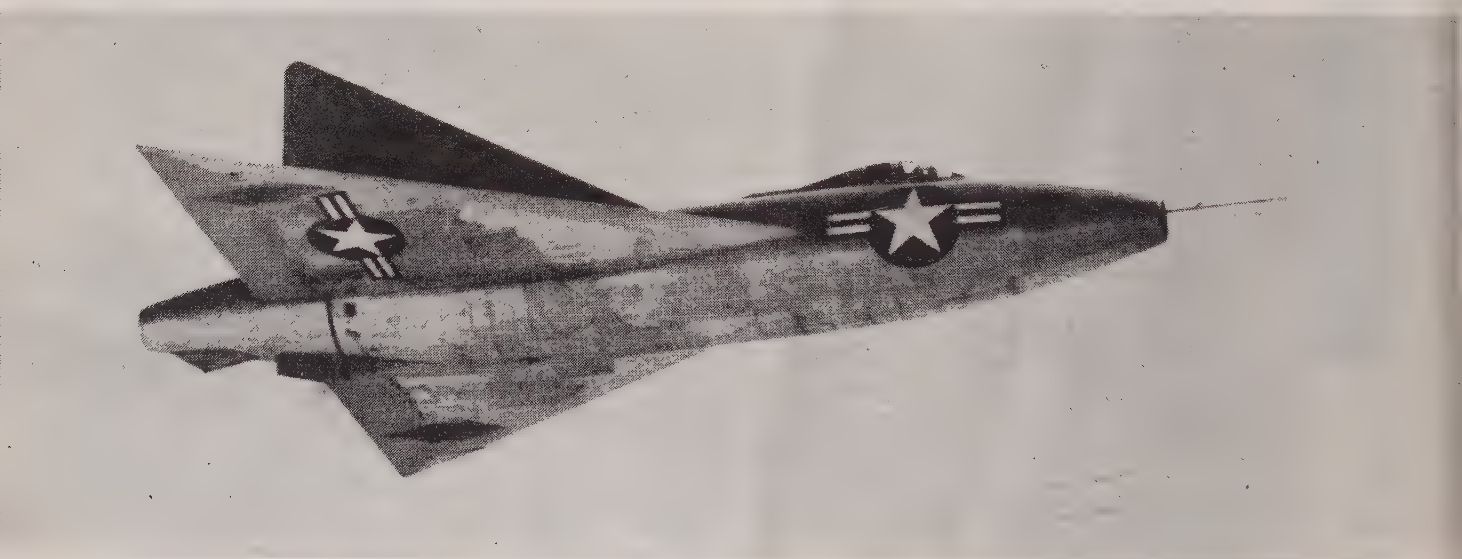
Today the "flying wedge" is Convair's airborn test-cell, the delta-wing XF-92A, called by the Air Forces, a jet interceptor fighter.

Shaped like an equilateral triangle—with a minimum of fuselage added for powerplant and pilot—this research plane closely resembles a grade-school youngster's folded-paper dart. The XF-92A has its rudder on top, but aside from that, the airplane looks definitely like Junior's classroom missile.

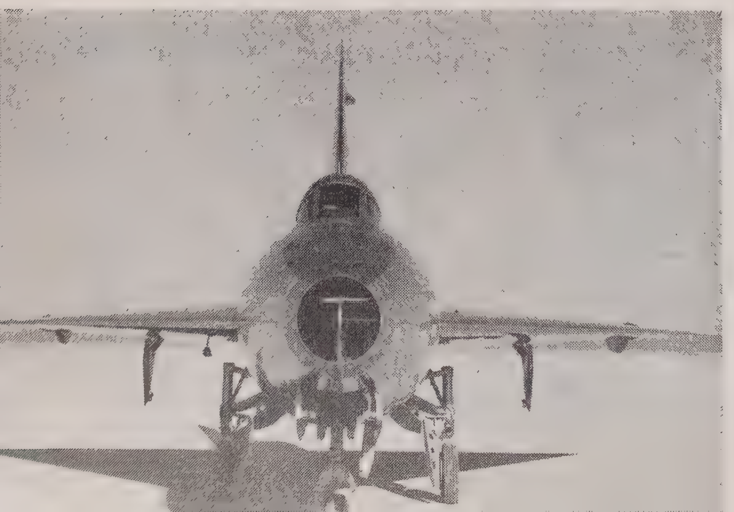
Completely unconventional in design, this Convair delta-winged ship is the first airplane with a triangular-shaped wing to fly. The only other delta wing yet flown, the British Avro 707, was demolished on an early test flight. A number of high-speed jet fighters have 35° of sweepback, but the 60° angle of the delta wing is something completely new in the field of aviation.

The name for this unusual design goes back to the fourth letter of the Greek alphabet, Delta. This

SWEEPBACK of 35° on most jet fighters seems of little proportion compared to the 60° angle of the XF-92A's triangular wing



PILOT in -92A's cockpit has good forward visibility, but rearward visibility in prototype is limited to wing's leading edge



letter is shaped like an even-sided triangle with the point at the top. The XF-92A flies just the same way—with the point in front.

If you listen to Chief Experimental Test Pilot E. D. "Sam" Shannon and Project Engineer Thomas M. Hemphill of Convair, this radical delta design may furnish answers to many of the interceptor-fighter problems of today.

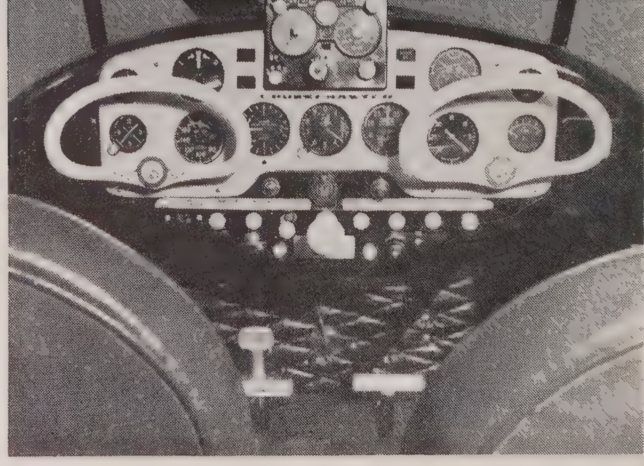
"With adequate power, this type of ship incorporating the best features of the design would outmaneuver the socks off anything yet built," said quiet-voiced test pilot Shannon during an exclusive SKYWAYS interview on (*Continued on page 52*)

JET Interceptor: XF-92

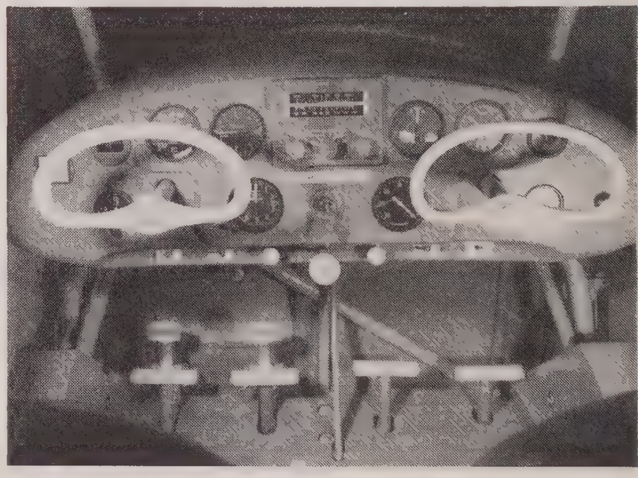
TAIL SECTIONS in delta wing are eliminated by use of "elevons" for elevators and ailerons on wing's trailing edge

TIP of ship's tail is 18 feet above ground. Ship's pilot insists he's landed XF-92A slower than he's landed Convair 240

Pilot's Report—Bellanca "Cruisemaster"

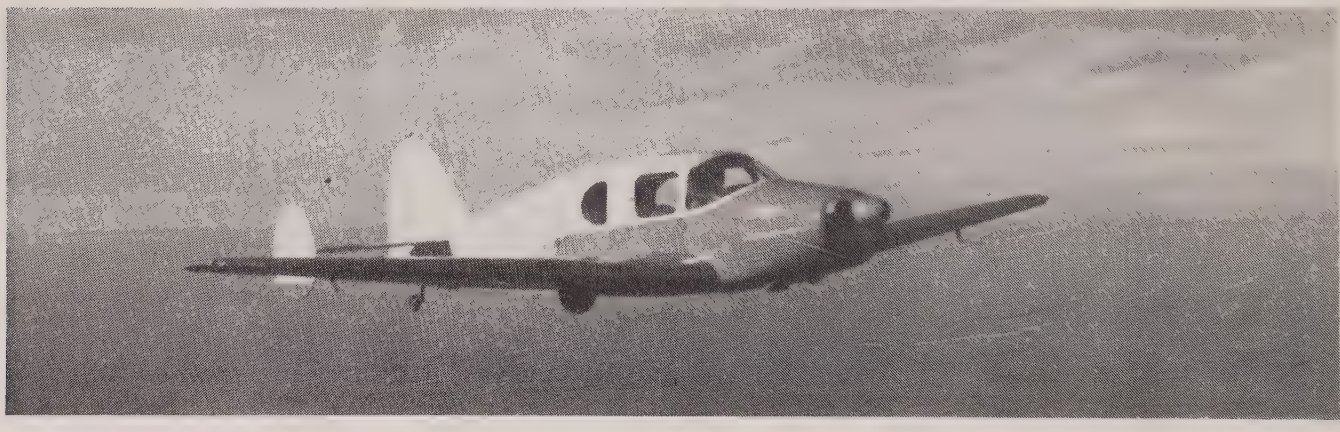


INSTRUMENT PANEL in the new Bellanca *Cruisemaster (above)* is much more complete and better laid out than the panel in its predecessor, the *Cruisair (below)*. Note upholstery in leather from floor up in back of the *Cruisemaster's* panel

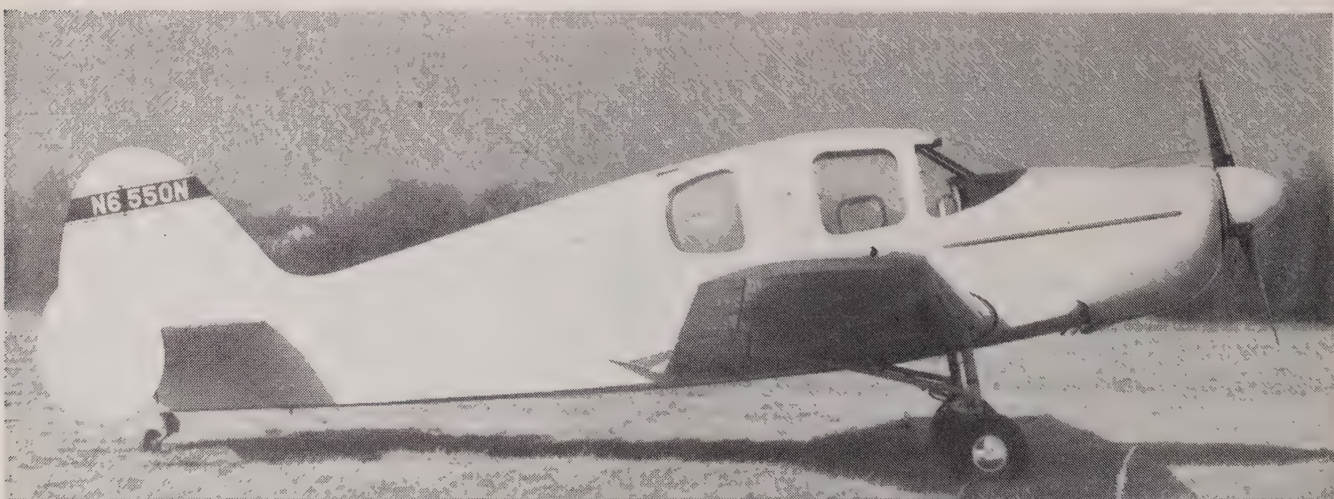


By L. M. HORTON

We arrived at "G.M.'s" workshop in New Castle, Delaware, just as test pilot, Jack Keaveny, made the last fast pass over the runway. The final check of the new Bellanca 190 was over. As the ship rolled up in front of the hangar and stopped, engineers, designers, and mechanics strolled over to make last-minute adjustments and finishing touches—addition of spinner and speedy installation of a dome radio speaker.



CRUISEMASTER *(below)* is similar in general appearance to its predecessor, the *Cruisair (above)*. Rudder and tip fins are larger on this year's model, and its gear and flaps are now hydraulically operated. The flaps are now 12 inches longer



VPLANE DESIGNER Giuseppe Bellanca, president and founder of Bellanca Aircraft Corp., built his first plane in 1909

Pretty good for the first ship hot off the production line that morning!

A slick yellow model, the *Cruisemaster* seems heavier and sturdier than its predecessor, the *Cruisair*. Actually, it has enough new features and changes to qualify it as an entirely new product.

From spinner to tail-light, the *Cruisemaster* measures 23 feet $\frac{5}{16}$ inches; wing-tip to wing-tip, 34 feet 2 inches. Rudder and tip fins are slightly larger than in the former model. Gear and flaps are now hydraulic. The gear leg is thicker, more rugged. The full-cantilever wing, made of plastic-laminated plywood, has fewer ribs, and its $\frac{1}{8}$-inch-thick skin gives the *Cruisemaster* a greater weight-strength ratio than any competing low-wing ship in the private class today. The flap is 12 inches longer, and the aileron controls have been housed internally to eliminate the "horns" *(Continued on page 18)*

BELLANCA for 1950 measures just over 23 feet from spinner to tail-light and has a wing span of some 34 feet 2 inches

PILOT'S WINDOW within a window is an innovation on the new four-placer. In addition, all the windows are larger

on the exterior surface of the wing.

Striving for clean line, compactness, and convenience. Bellanca has housed all external radio equipment in the wing! The standard broadcast receiver consists of sheets of aluminum-foil glued to the inner surface of the wing. Antennae and rotatable loop, which is adjustable and can be pulled out, are easy to get at through inspection holes in the bottom surface of the wing. There is a VHF transmitter and receiver, a 75-megacycle marker beacon, and provision for omni-range. (Omni-range hook-up is optional equipment, the rest is standard.)

Waiting for the O.K. to fly the ship for our report, we checked for other improvements. What appeared to be an inspection hole in the lower right side of the fuselage, below and slightly ahead of the horizontal stabilizer, proved to be the battery housing. We opened the two cameloc fasteners and raised the plate. Braced on a double metal rail, the battery slides out for easy, quick service. In cases of emergency, an automatic cut-off relay at the battery is actuated once the switch is cut, so that the possibility of "hot leads" (high voltage) is eliminated.

The baggage compartment, also on the right side of the ship, is a spacious one. The base is polished mahogany with raised strips or "planking" of mahogany to keep the 110 pounds of allowable baggage from shifting about. Sides and top are metal. An optional feature here is the installation of an additional 25-gallon gas tank in the compartment for increased range. This will take up only 30 per cent of the total space volume.

Standard gas load in the *Cruisemaster* is 40 gallons in the wing tanks, giving a range of about 3.5 hours or 630 miles. With the extra tank, the full 65 gallons will raise the range to 5.7 hours and somewhat over 1,000 miles. The ship's empty weight is 1525 pounds, utility weight load is 2400 pounds, and normal load, 2600 pounds. The customer has plenty of choice when it comes to weight distribution!

We walked around to the nose of the ship. With the spinner on, a thin chrome strip on each side of the nose, and chrome hub caps on the wheels, the ship has a "racer" look about it.

The cowling is the automobile type with three cameloc fasteners on each side for easy maintenance. A single cowl flap is on the underside of the nose, and a chrome grill in front. Behind the grill is an air filter (standard equipment) for carburetor air. We unfastened the cowling and checked the interior. The engine, bonded and shielded, is a 190-hp Lycoming, O435A series.

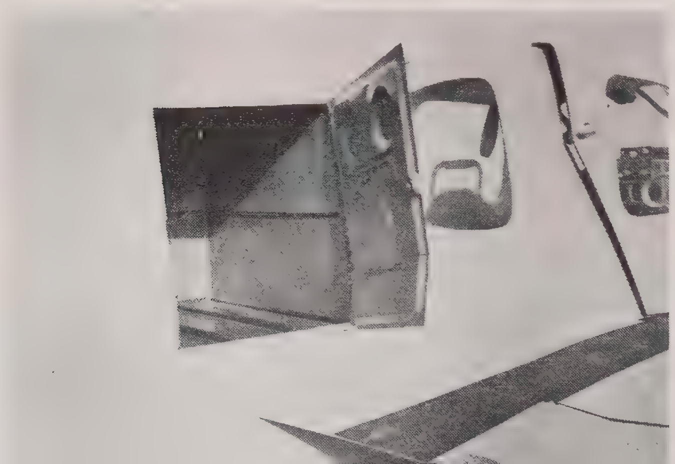
When it comes to props, the customer again has his choice. The ship is approved for the Hartzell selective fully-controllable pitch prop and the Aeromatic prop with altitude control. This ship was equipped with the Aeromatic.

We got the word to come aboard and try it out so, with a short step up on the strip-mat on the right wing, we entered the cabin. If you need a hand-hold, it's there in the form of a slot in the top-right side of the fuselage.

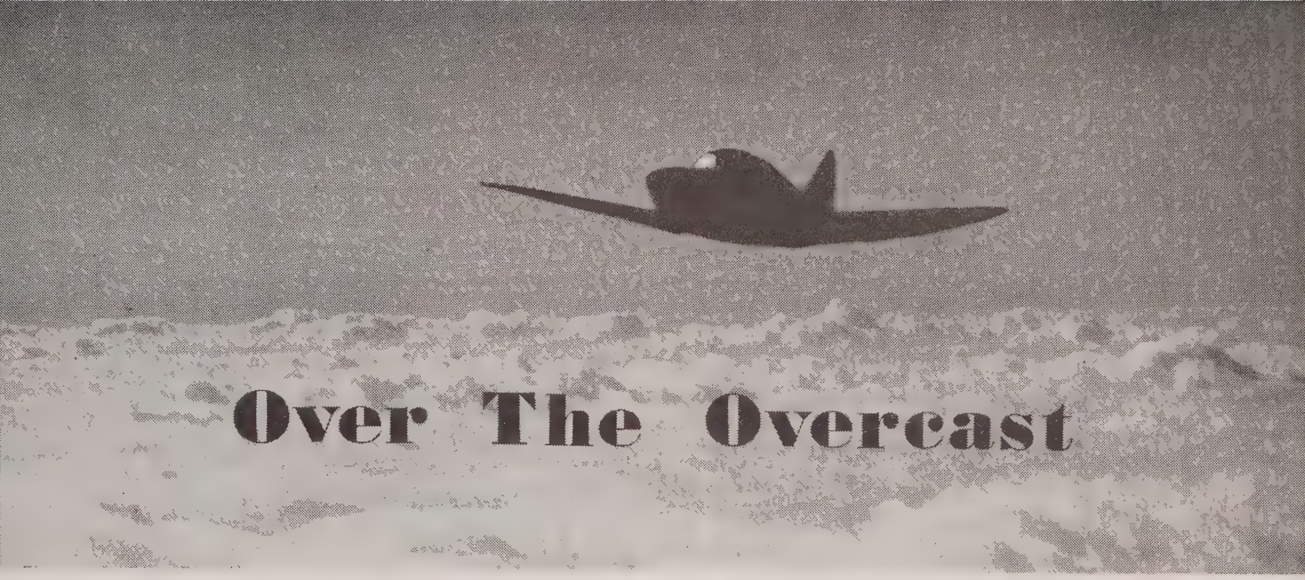
Additional improvements over the old model were obvious. The windows are larger. The door, a single-piece, all-metal one, is larger, and is equipped with a spring-loaded door-stop which keeps it open automatically when pushed. The door molding is bird's-eye maple.

Springy, foam-rubber seats are upholstered in a DuPont-designed nylon whipcord and leather combination. (Maroon-colored (*Continued on page 44*)

BAGGAGE COMPARTMENT is on the right side of the ship. Its base is polished mahogany, and sides and tops are metal



LANDING GEAR is fully retractable, hydraulically operated. At 1600 rpm, a bell rings to let you know the gear is up



Over The Overcast

By BOB ARENTZ

NOTHING causes a writer as much frustration as having a good story that he can't tell. Yet, almost always the best stories are in that restricted category. So, for once, because I believe this little tale packs a powerful moral, I'm going to tell you about a friend of mine and a little ride he took one day in an airplane. I saw him when he landed, in fact I helped push his airplane in. He acted a bit odd at the time, but nobody questioned him very closely. Two years later, he told me what had happened. When I have told you, you'll see why we both think it is best to keep his identity a secret.

It was along in the early spring, days of heavy cumulus cloud formations, major storms forming over large areas on short notice, with lots of squalls and snow storms and low-lying scud around the hills. Yet, here and there, patches of sun came through and at Rock Springs, Wyoming, the sky was 75 per cent clear.

My friend had his wife and baby with him in a popular two-place plane and they landed at Rock Springs to fill the tank with gas. As usual there was about a 15-mile west wind aloft, but it was only 160 airline miles into the Salt Lake valley and he figured he could make it without any trouble.

Shortly west of Rock Springs he climbed to 10,000 to get above broken patches of fleecy clouds.

He had checked the weather sequence and the forecast before leaving R.S. They showed broken and scattered clouds between Salt Lake and Knight, Wyoming, with a prediction that it would remain broken around Ogden, though probably closing in at Salt Lake City. Weather to the northwest of Ogden, around the Great Salt Lake, was scheduled to remain CAVU.

There was a ridge between Ft. Bridger and Evanston that had socked in. No mountains, you understand, because the airway through Wyoming isn't in a mountainous country, but just this one high ridge with scud curtaining the top of it.

Up above the stuff the sky was blue, the air was fairly warm, and the flying was very smooth and unruffled. Of course the winds were higher than predicted, and undetectable, but 160 miles in a good ship isn't far and he had a four-hour gas supply. Too, the weather was open at the other end. So he gradually kept climbing, staying 500 on top and reckoning his position by guess and by golly.

After two and a half hours, he still hadn't broken out into the "scattered" stuff predicted for Salt Lake valley. Well, maybe the winds were closer to 45 or 50 mph, which would cut his true ground speed to 55 or so. He still had lots of time, he figured.

And, besides, there was no percentage in going back now. A radio weather sequence from Ft. Bridger radio had given Rock Springs snow and high winds and an 800-foot ceiling as the weather worsened there.

After he had been flying three hours, my friend was at 17,000 ft., and fortunately the tops of the clouds stopped going still higher. It was bitterly cold and he was feeling the strain and fatigue and worry.

The endless clouds rose far above all mountains in the Rockies and there wasn't a landmark to be found. Of course that's just the time you could expect the radio reception to get bad, so he couldn't locate himself on some leg of the Ogden range and at least determine when he crossed the Wasatch Mountains of eastern Utah and got out over the valley.

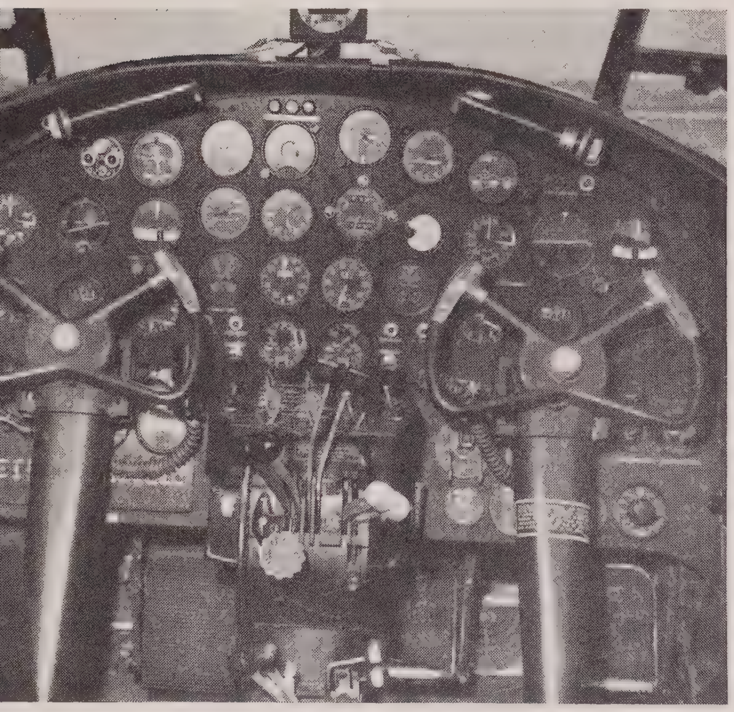
His wife was beginning to worry, too, and the baby was very uncomfortable, tired, cross and crying.

He knew that, roughly speaking, he'd be better off to keep flying west. The most mountains in one hunk were the Wasatches, and by and large the farther he got west the less likely he was to hit something solid when he (*Continued on page 42*)

Dollars & Sense in Exec Flying

There's profit in airplane ownership and economy in executive operations

By COL. N. F. SILSBEE



EXECUTIVE PLANES such as Monsanto's "Prairie Wings" are as finely appointed cabin-wise *(above)* as they are complete in instrumentation. Control panel *(left)* was installed by Remmert-Werner in a converted B-25 bomber

MANY years ago someone asked Mr. J. P. Morgan how much it cost him to operate his yacht, the *Corsair*. Financier Morgan's classic reply was, "If you have to ask yourself that question, you shouldn't own one!"

There are some uninformed businessmen today who consider ownership of an executive or business plane in a similar category. That such is *not* the case is widened by the growing number of companies and corporations that are operating business aircraft. These owners are daily proving the profit in airplane ownership and the economy in operation. Cost to them is not an unknown factor—it's a very real factor, and economy of operation is the rule of the day and the yardstick of success.

By economy in this case we don't mean cheap. Operating an executive plane of any type—from the single-engine four-place Cessna 190/195, *Navion* or *Bonanza* to the Twin Beech, *Mallard* or converted DC-3, *Lodestar*, or B-23—will run into an impressive total of dollars per year. But using the word economy in its root meaning of thrifty administration and sound management, we are right on the beam.

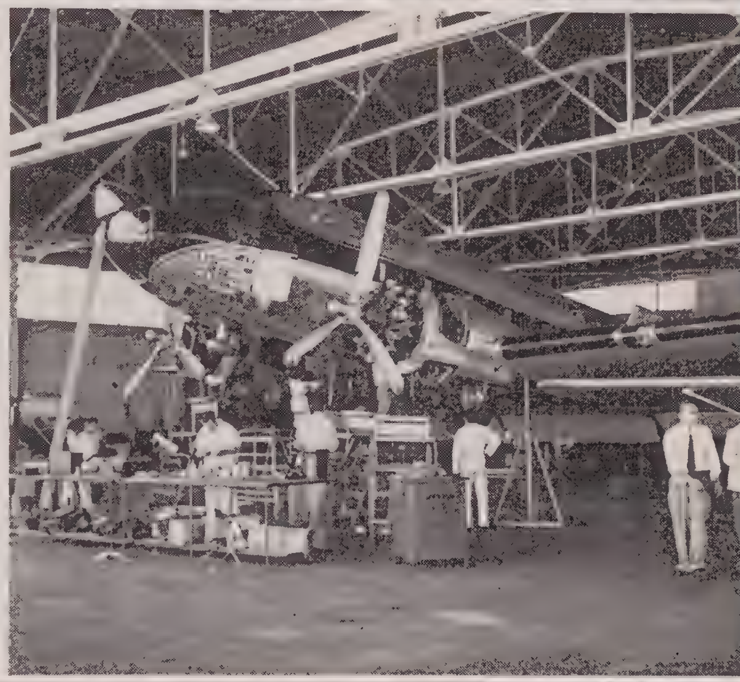
In a survey of American industry and commerce, covering more than 50 separate types of business

LOCKHEED LODESTAR is popular company plane. This one features airline-type seating arrangement in its cabin

TWIN-BEECH is probably most widely used as an executive transport. Its cost per passenger mile, based on 600 hours per year, runs between nine and 12 cents as compared to the *Navion* or *Bonanza's* cost of from 5 to 7 cents

activities, nearly 25 per cent of the companies which replied stated that the "economy in time and money" and the utility of their own aircraft being at their beck and call were of great importance to them.

This is borne out by the tremendous increase in business flying since the end of the war. In the spring of 1946 it is doubtful if 2,000 executive-type planes (four-place and up) could be mustered in the entire country. Today there are nearly 2,000 multi-engine aircraft alone and well over 6,000 single-engine four-place planes (*Continued on page 47*)



TODAY'S business or executive fleet includes nearly 2,000 multi-engine planes and over 6,000 single-engine four-placers

Lightplane Mayday . . . GCA

SKYWAYS' PILOT, at controls of a Cessna 170, brings ship in to Mitchel AFB after being guided to runway by field's GCA unit

By JERRY LEICHTER

THE small group of hangar pilots hitched their chairs a little closer around the oil heater as Charlie raised his hands and voice in disgust.

"What d'ya mean you *had* to land on that farm?"

"Well," the somewhat brow-beaten recipient of the disgust replied weakly, "the weather wasn't getting any better and if I'd waited any longer I really would have been lost. I saw an opening in the overcast and decided I'd better go down. Okay, so I smacked up the plane a little, so what? What else could I have done?"

"Used your head," Charlie snapped as he spread the sectional map out on his lap and jabbed at it with his pencil. "You came down here . . . your last check point was here . . . you knew about where you were. What in h—— does this Air Force base over here look like? It's not more than 20 minutes from where you were. Couldn't you use your radio?"

"That base was behind me," Ed replied, "I didn't know how fast the ceiling was closing. How could I take a chance with only a low-frequency set? Sure, if I'd had VHF, I could have been talked down."

Charlie jabbed the pencil through the map again, and groaned, "What's the use!" He picked up a

WEATHER OPEN, lightplanes have no trouble following tower operator's instructions, but GCA is that extra safeguard

copy of Airmen's Guide and turned to the first page. He underlined a couple of sentences in the GCA instruction section, then handed the publication to the errant pilot, "Here, you read it."

Ed read it through once silently, then read it again aloud. "*Air Force towers will relay GCA instructions on 200-400 Kc band to civil aircraft not equipped to receive VHF or HF. Most Navy and CAA GCA units can transmit instructions directly on tower low frequency.*"

Ed thought a moment, then wondered aloud, "Do you think this GCA stuff will really work for a small plane?"

SKYWAYS was curious about the same thing, so we went out to get the answer.

Arrangements were made with the 1802nd AACS Group (Airways and Air Communications Service) at Mitchel Air Force Base, L. I., N. Y., to schedule a comprehensive test routine to check the GCA tower-relay system, not only for low frequency communications effectiveness but to see whether or not it could bring a lightplane pilot right in on a runway.

Al Bennett, Skyways Advertising Manager and a capable and well-known pilot, borrowed a new Cessna 170 from Jim Welsch at Roosevelt Field for the test.

Al, your reporter and several of the AACS men conferred on the arrangements for the informal test routine, and agreed on a time. The tower was alerted beforehand. With one of the regular check pilots of the AACS group flying as safety-observer co-pilot, Al took the Cessna up to a point over the Long Island coastline about 10 miles from the field. The writer stayed on the ground at the GCA truck to watch the home end of the demonstration.

For those flyers who are still vague about Ground Control Approach, it might be explained that pulses of ultra-high-frequency radio energy are sent at rapid intervals from ground transmitters into the approach area. When these pulses strike an approaching plane, they are reflected back to form light spots or "pips" on ground radar screens. The changing position of the (*Continued on page 42*)

GCA TEAM gives instructions to aircraft on its landing approach. Final controller is the man with microphone

GCA TRUCK houses electronic equipment which permits the GCA team to guide aircraft to safe landing in bad weather

Hell in the Cockpit

ROUTINE FLIGHT in a Navy PB4Y *Privateer* became a maelstrom of near mishaps to Clambake *(left)*, Pete and the author

By Lt. (jg) HANK SEARLS, USN

IT HAD started out to be a normal night instrument flight in a PB4Y *Privateer*. As normal, that is, as any flight that goes up on the board as "Routine." Maybe it was because Clambake was born under the wrong star, but every place Clambake went, all hell was a cinch for company. On this trip, Clambake rode the righthand seat. I shoulda stood in bed!

Pete, Clambake and I were just keeping our hand in. Pete is a Chief Aviation Machinist Mate who was born with the answers and a natural mistrust of the workings of a pilot's brain. Clambake was a copilot, but just because I slid into the lefthand seat first. The mission? A flight to kick the kinks out of our *modus operandi*.

We'd been out for some time and were now on our way back to base, just bracketing the southwest leg of the range toward the low cone and home, when the hop fell apart at the seams.

The rains came . . . and with it daggers of lightning that split the sky all around. The *Privateer* bobbed like a cork in a high sea. One second I was suspended a dozen inches in the air, and the next I was being pushed through the floor of the cockpit.

Down on one wing . . . down on the other . . . nose up and wing down . . . nose down and wing up . . . nothing was level, nor did I ever think it would be again. This was turbulence that had the ship on the gyro horizon wobbling like a drunken bumblebee in a typhoon. The rate-of-climb needle raced to the top of the dial. I jammed the nose down . . . and the needle dropped to the bottom. I fought the controls and tried to trim up. That part of my mind that was trying to read through the static to get the radio range reminded me I was swinging off the beam to the right. I kicked in a little rudder and swung 5° to the left. (*Continued on page 54*)

NAVY'S PB4Y, though obsolete now, was an effective land-based patrol bomber built for Navy use in World War II

NAVY FLYER, Lt. Hank Searls, knows from experience the rough ride a routine familiarization flight can give

DUSTING is an early morning proposition, the noise of which is only exceeded by a hammer symphony played in a boiler works

Dawn to Dust

I don't want to disillusion anyone, but . . .! I still have a few female friends who think it is just too thrilling to be married to a flyer—a glamour boy with wings. When the boys . . . and my husband's included . . . are dressed for dusting and have their gas masks on, they're about as glamourous as a sewer inspection crew.

By MADELINE RILEY

LIFE OF RILEY—Madeline, that is—is Sam, the author's duster husband

For the last two years my crop-duster husband and I have been living in a trailer parked cozily alongside a hangar. This is convenient for Sam but a triple-decked pain in the neck for me. We're a good eight miles from a grocery store . . . and some times it seems we're that far from the Chic Sale that's stationed way down a gulley. Since the boss lives another mile down the road, our trailer home appears to be the office of the dusting company and I never know when some farmer is going to poke his head in the door (door knocking is not a rural practice), asking for one of them "airplane drivers." Another annoying disadvantage is that the runway opposite the trailer has developed a few chuckholes and on an average of once a week one of the planes gets stuck in one, requiring considerable blasting of the throttle. When I hear this, I frantically start closing windows but I never seem to quite get them all down before clouds of dust come billowing in.

I defy anyone to sleep through the usual morning racket around a dusting company. The day starts (at 4 A.M.) with the arrival of the loaders, a good half hour before Sam and I are ready to get up. One of the men has

POWDER used in crop dusting is often very inflammable, requiring extreme care in handling both in and out of the plane

a Ford equipped with echo straight pipes. This he winds up in second gear and allows to back rap for the last quarter mile down the runway. It sounds like the Battle of the Bulge and I could not help smiling gleefully the other day when I was told he had gotten a ticket in Fresno for such a racket. I actually felt like writing a thank you note to the arresting officer. This racket, however, is only the overture. The next 20 minutes are spent dropping empty 50-gallon gas drums off of the pick-up truck onto the concrete hangar floor. Since the hangar is covered with sheet iron it acts something like grandma's ear trumpet magnifying sound to the point of madness.

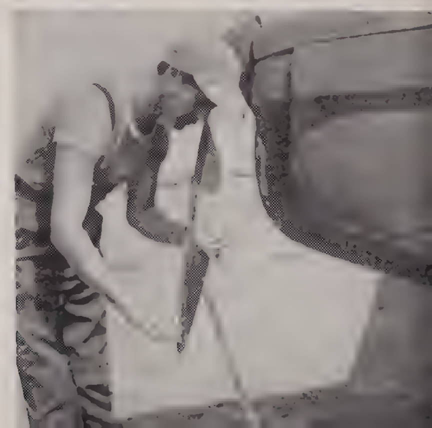
Sam is one of the world's heaviest sleepers and pounds his ear for this last half hour of sleep. Like a lot of heavy sleepers he makes it a major operation to get him out of the bunk—the colder the morning the harder it is to bring him to full consciousness. When we were first married and I was still a bride, I wasted a lot of time pleading and wheedling him out of bed. Now things are different. I call him once. If there is no answer, I simply brace myself against the back wall of the trailer, double up my legs and shove him off onto the cold floor. Then all I have to contend with are his sleep befogged attempts to climb back into bed "just to rest his eyes for a minute." I know this sounds a bit brutal but, believe me, it is absolutely necessary. Once I can get a cup of (*Continued on page 45*)

CROP DUSTING seasons number two in California: one in May, June for insecticides, and one in September for defoliation

OVERLOAD DAMAGE

LINES, tubes, skin sections are all subject to injury from overloads. Check each for bends, looseness, etc.

BLOW-OUT may cause a rough landing, lead to overload damage. Inspect tires carefully. Check prop alignment



Know what produces overloads, the damage it can cause . . . and check!

By GILBERT C. CLOSE

YOU know what happens when you drop your watch on the floor. Unless the crystal breaks, it'll probably look as good as it did before, but chances are it'll stop running or will begin to gain or lose time. The damage isn't visible, but it's there nevertheless. The shock load caused by the blow against the floor was transmitted through the case to the inside works, and the delicate innards of a timepiece aren't designed to withstand shock loading.

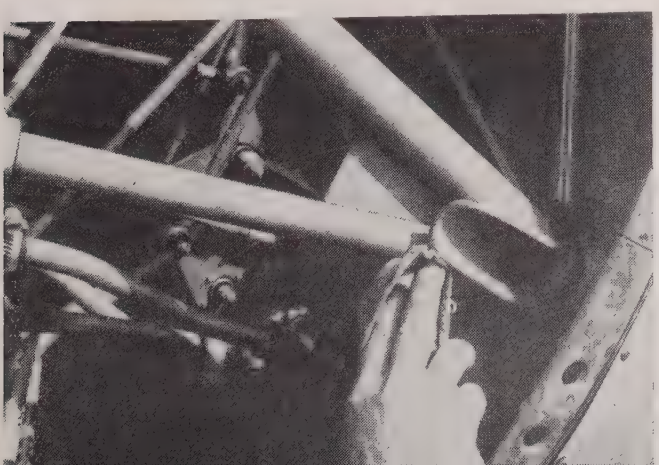
The same line of reasoning applies to an airplane that is brought in to a rough landing, or that has unusual loads imposed on it in other ways. It may look just the same as it did before. It will probably fly. But if the load was greater than the design strength of any of the parts it affected, something somewhere had to give. The damage may not be noticeable. It may not affect immediate performance. But ignoring the possibility of damage is like toting a secret time bomb in the baggage compartment. It'll be too late when it announces its own presence.

Every part in an airplane is designed for specific steady or re-occurring loads, with a margin of safety for occasional overloads. Weight considerations prevent designing for accidental overloads, or consistent overloading within the margin of safety. Detection of damage caused by overloading is a true function of inspection. This inspection must be supplemental to regular line inspection and demands special knowledge and techniques.

The pilot should school himself to recognize operational and non-operational factors that produce overloads, and should be able to analyze overloads relative to their ability to cause damage. This is simple and requires only (*Continued on page 58*)

STUNTING a conventional plane may produce overloads that result in structural damage, so don't stunt your plane

ENGINE MOUNT should be cleaned, checked for cracks. After an overload, check all structural welds for weakness



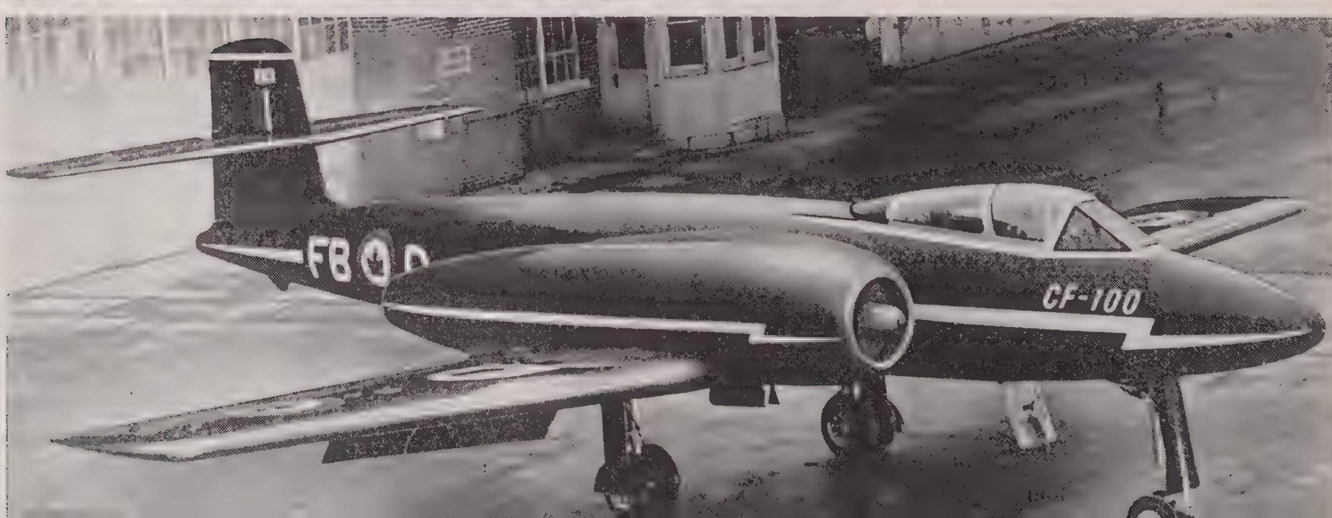
FITTINGS that are loose and internal disfiguration will often show up if you vigorously shake the plane's wing

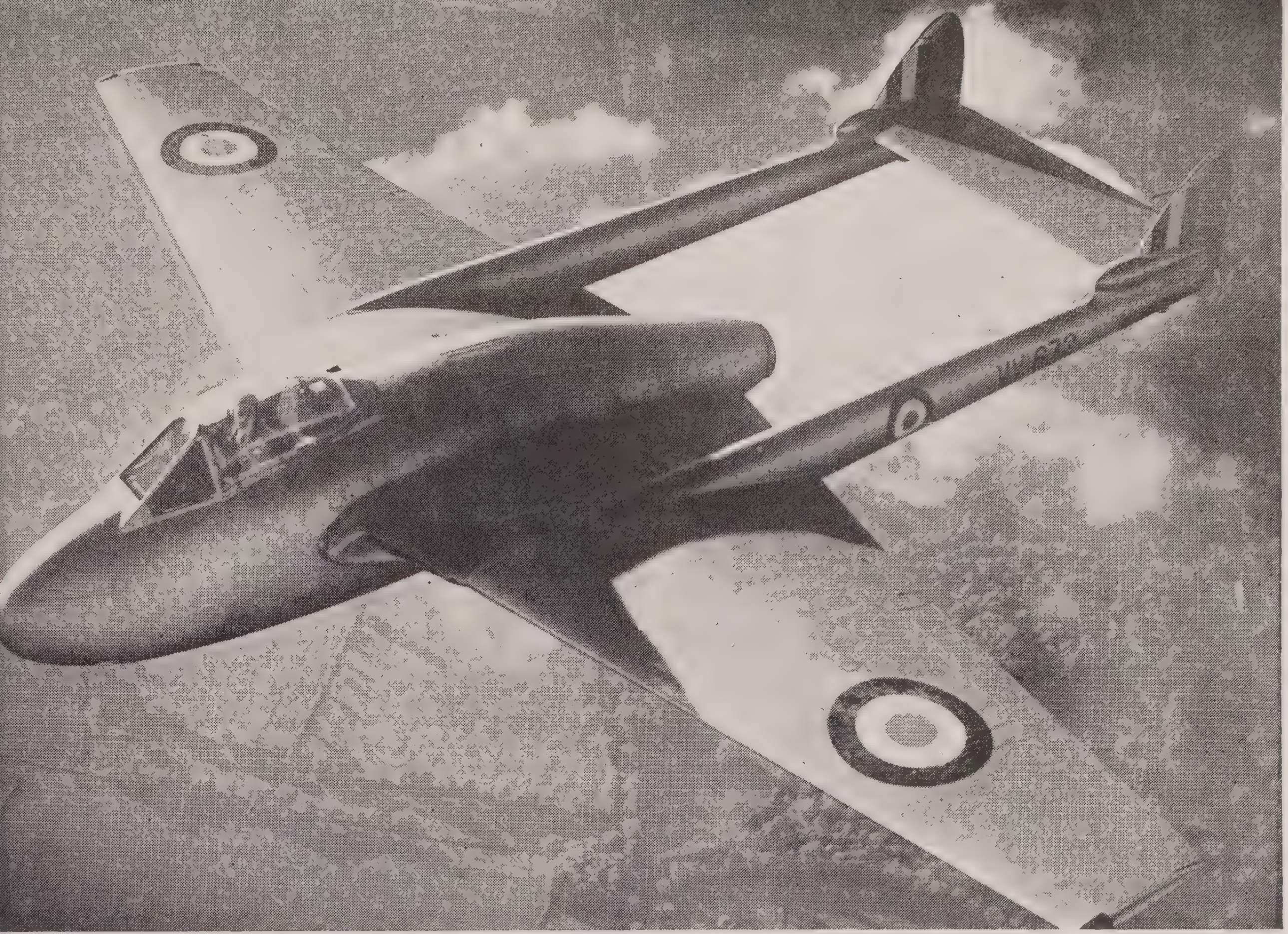
DOUGLAS C-124 *Globemaster II* is pictured here in its first flight photo. The USAF's largest production transport, the C-124 has a gross weight of 175,000 pounds and can carry a payload of 50,000 pounds over effective ranges. Converted to troop carrier missions, the big C-124 can carry 200 troops and their field equipment in its double deck fuselage. According to late information, the USAF has ordered 30 C-124's.

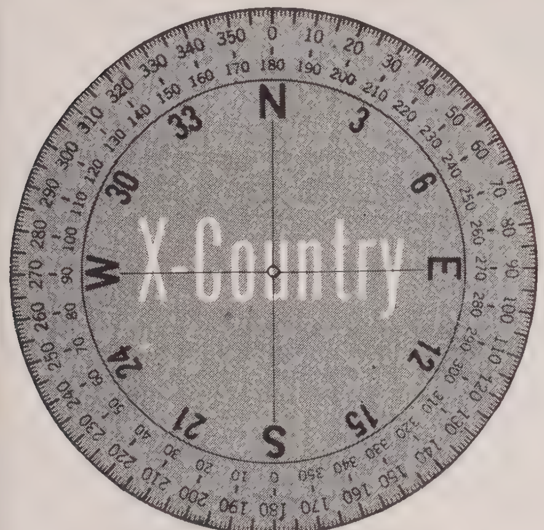
BRADLEY SPECIAL is not a new airplane but it is an interesting one owned and probably built by Ben R. Bradley, Jr. of Fort Lauderdale, Florida. It is a single-place ship, with a gas tank mounted in the space that was orignally intended for the front seat. The airplane is shorter than a Piper *Cub*, and it has clipped wings. The engine is 100-hp Lycoming. Although the main fuselage of the *Bradley Special* resembles a *Cub*, its wings, landing gear and tail are not *Cub*-style.

AUSTER AUTOCRAT, one of Great Britain's best-known lightplanes, is here being flight tested with Goodyear crosswind landing gear. The ship is a three-placer powered by 100-hp Blackburn *Cirrus Minor* engine which gives it cruising speed of 100 mph and a still-air range of 320 miles. It has stalling speed with flaps of about 28 mph.

AVRO CF-100 is the first frontline fighter plane to be designed in Canada. Built by AVRO for the Royal Canadian Air Force, the CF-100 is reported to be "the most powerful fighter in the world and first long-range all-weather fighter plane of its type." No other information has been released concerning this Canadian-designed twin-jet.



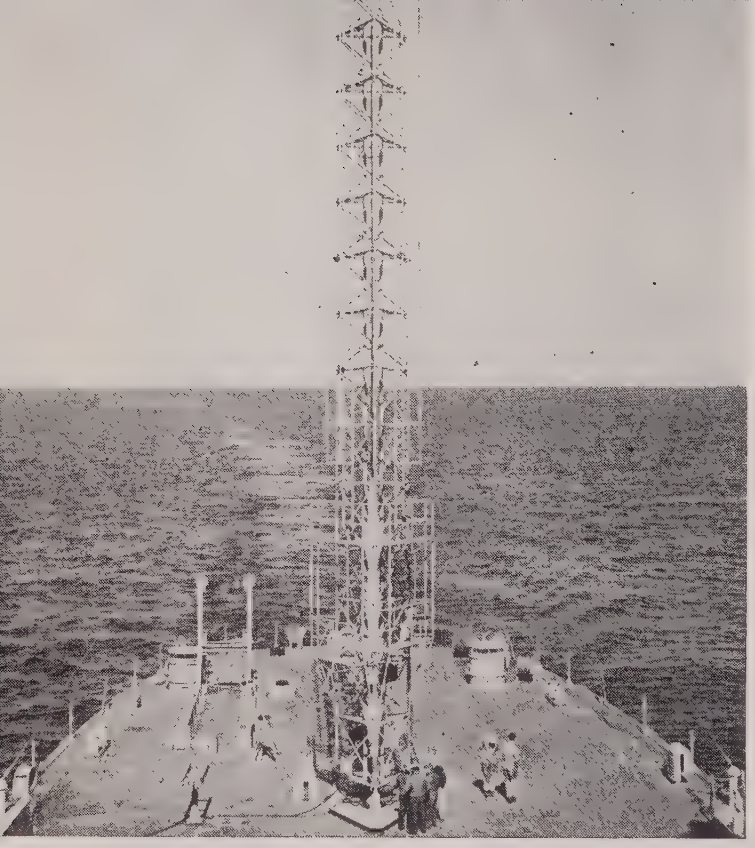




DE HAVILLAND *VAMPIRE* is shown here in one of most interesting flight photos ever made of this ship. Camera has caught a "ghost" wing tip on leading edge of starboard wing. The exact cause of this phenomenon is not known. This ship is being built for RAF, RCAF, Royal Norwegian, Royal Swedish, Royal Indian Air Forces and also for the Swiss Air Force and Venezuelan Air Force.

SIKORSKY H-19 helicopter is a new 12-place 'copter developed for the Air Forces. Powered by 600-hp Pratt and Whitney *Wasp* engine, the H-19 has a designed speed of more than 100 mph, and a combat range of 280 miles. Feature of this helicopter is location of the engine in the nose of the aircraft where it is easily accessible for maintenance work. Commercial version is S-55.

500 Miles Up!



Flight beyond the earth's atmosphere is not only possible but very probable

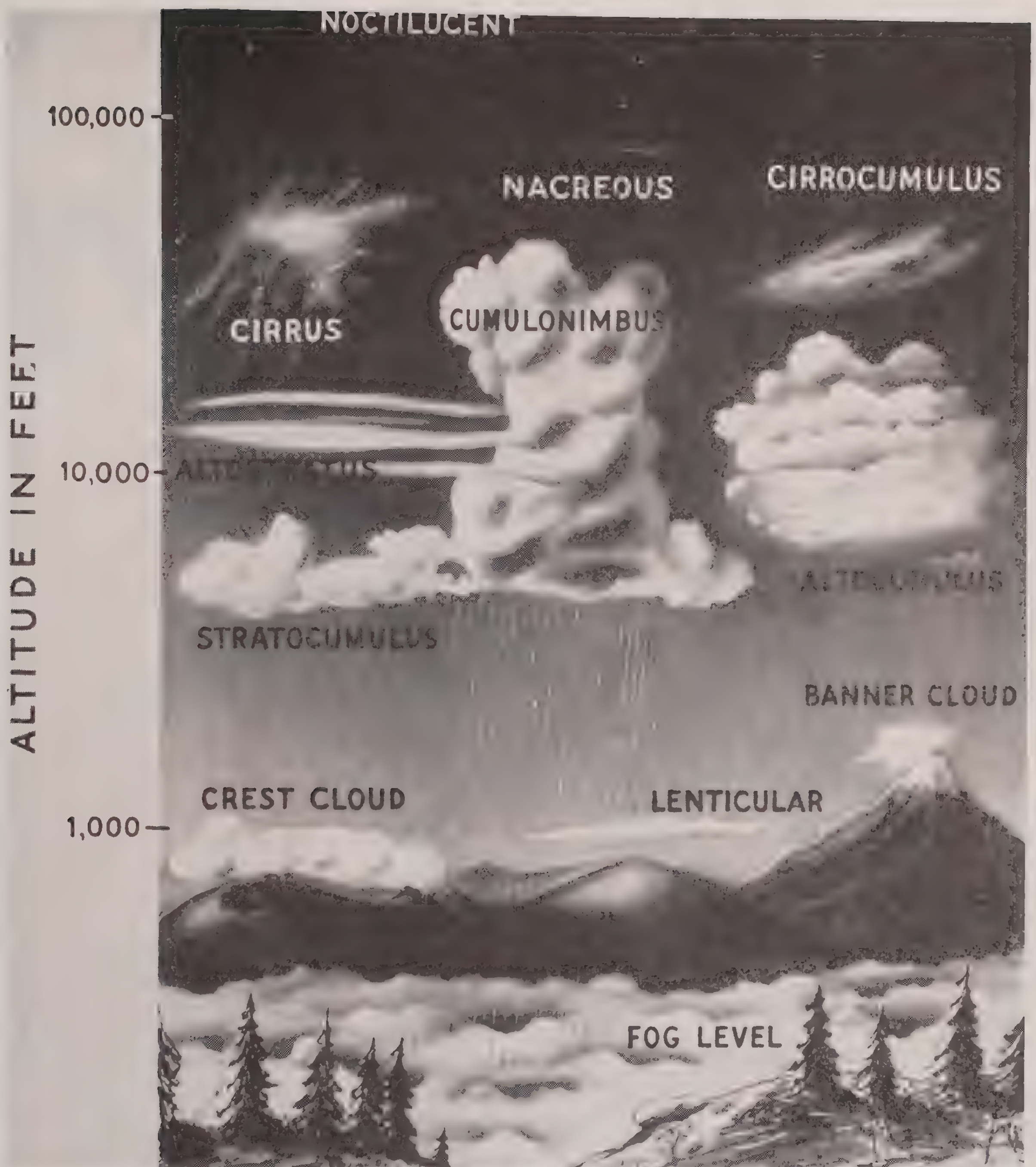
By HOWARD E. ROBERTS

Engineer, Douglas Aircraft Co.

Great advances in the field of jet propulsion were made during World War II, and these advances have reduced to reality many ideas previously found only in comic strips and scientific fiction. Speeds have been achieved which before the war were believed to be impossible. Although planetary escape and satellite vehicles are still some distance from realization, they *cannot* be called impossibilities.

Students of astronautics have investigated the

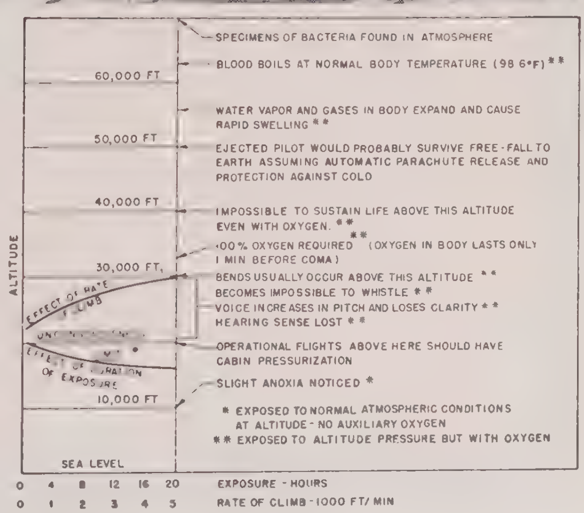
NAVY'S *Aerobee* rocket *(left)* rests in its launcher prior to being fired from deck of *USS. Norton Sound*. Camera installed in an *Aerobee* rocket took this picture of earth from an altitude of 57 miles. Note clarity of curvature



DISTRIBUTION of cloud formations above the earth are shown in this drawing. Most clouds occur below tropopause

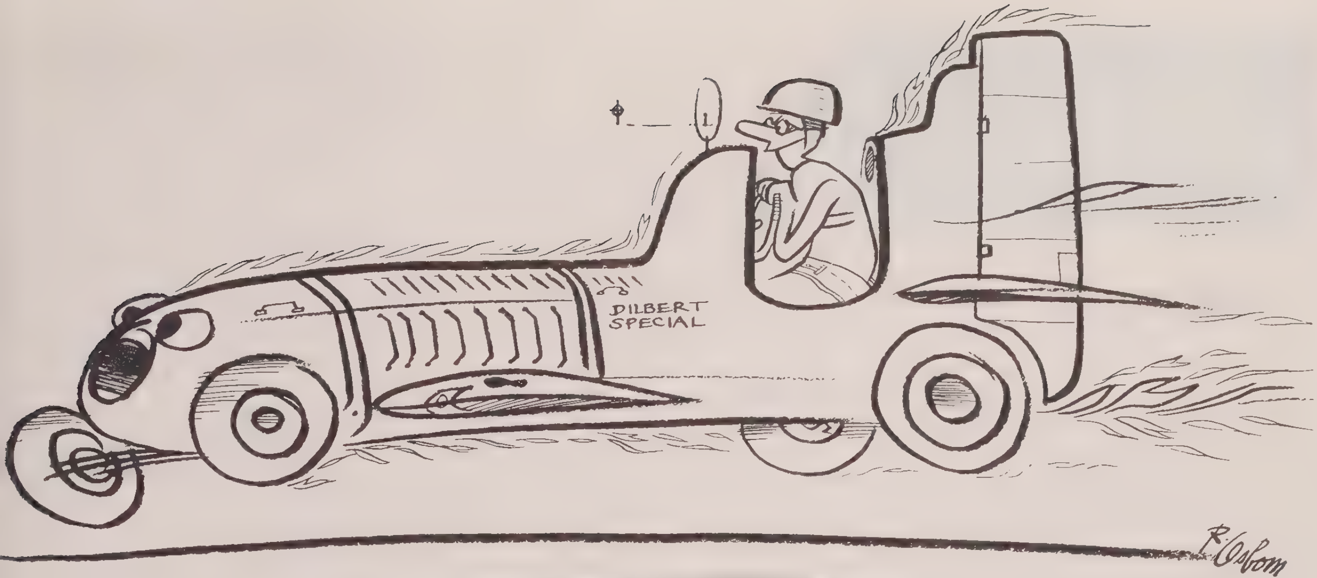
problems of planetary escape and satellite vehicles for many years. A recent survey shows that flight beyond the earth's atmosphere *could* be achieved with presently available rocket fuels. Such a project, however, would be expensive because of the extremely large ratio of gross weight to payload.

Development of atomic and other high-velocity rocket motors must be relied upon to bring a planetary-escape vehicle to (*Continued on page 43*)



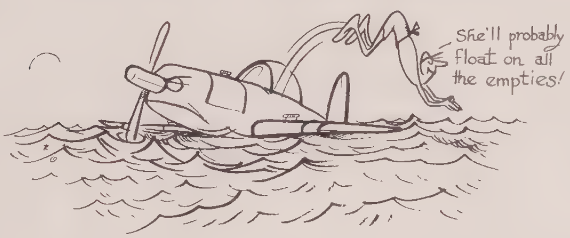
HUMAN BODY is very much affected by atmospheric exposure. The chart shows what happens at various altitudes

"One ship's slipstream is another ship's scythe!"



DILBERT

By S. H. Warner and R. Osborn



Tricycle Take-Off Technique—When he failed to become airborne after using up all but 800 feet of a 4,000-foot runway, the pilot of a large cargo carrier decided to go back and try again. At this point he closed all throttles and applied brakes.

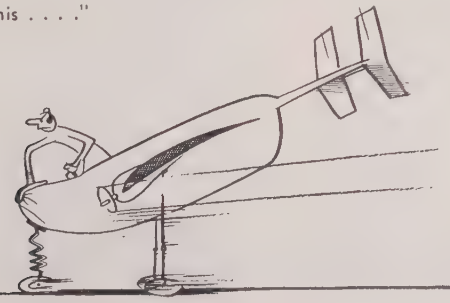
Hard application of brakes at high speed set up a terrific pressure on the nose gear, causing it to collapse. The airplane immediately settled on its nose and went off the end of the runway in this attitude. Damage was so extensive as to require major overhaul.

After thorough review of all attendant circumstances, the investigators issued an excellent analysis of this accident. Excerpts are quoted for information and guidance:

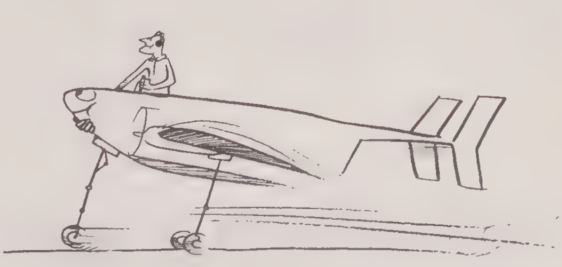
"The pilot's psychological reaction to a short runway and his first full-load take-off was to change his normal take-off technique. As he states, he deliberately held the nose wheel on the ground to get maximum speed before becoming airborne. As is well known, that technique is incorrect for this type of aircraft. He should have applied gentle back pressure on the controls as the plane was accelerating, to relieve the pressure from the nose gear, and to give the aircraft a positive angle of attack.

"When the pilot said that it seemed as though a 'dragging' effect suddenly started to take place, it actually did. What was happening was that the negative angle of attack, brought on by the nose-down position of the aircraft in the take-off run, tended to *fly* the aircraft into the ground. This is what created the 'dragging' effect, and it progressively increased as the speed increased, which further tended to hold the nose on the ground. Because of this, when he did try to raise the nose off the ground, the necessary (*Continued on page 56*)

"**NOT** This . . . ."



"**BUT** This . . . ."



Operational Engineering

Cleaning and Care of Aircraft Surfaces

The cleaning and care of aircraft surfaces—metal or fabric—is as important to the aircraft operator, owner and pilot as the proper observation of other types of maintenance and repair schedules. Periodic cleaning, using authorized materials and methods or various protective coatings, will not only reduce connected maintenance bills, but will also slow the rate of depreciation and in time will put a higher re-sale value on the aircraft than might otherwise be in order.

Postwar aircraft manufacture has emphasized all-metal construction and, more recently, painted metal surfaces, bringing along new cleaning, polishing and washing problems. Actually, whether the aircraft surfaces are fabric, part fabric and part metal, or all metal, the cleaning routines are fairly similar in all cases.

CLEANERS. Fabric-covered aircraft require careful cleaning to preserve dope and hand-rubbed finishes and to keep grime and salts from getting through minor scratches to undercut the protective coatings. Strongly acid or alkiline cleaners or harsh abrasives must not be used to remove encrusted dirt as they will always attack the top finish. The best all-purpose cleaning agent is any mild soap and water, applied with a semi-stiff brush. When used to remove encrustations, frequent flushing with water will aid the operation. Many of the newly developed household detergents will also do the job equally as well as soap, but special commercial soap compounds must be checked carefully for use, as some have been developed for operations where strong caustic action is needed.

Because of the amount of cleaning of all-metal aircraft done by airlines and large commercial operators, many aluminum cleaners for various types of jobs have been developed over the last few years. Some should never be used by owners of personal planes because they were developed to be used under strictly controlled conditions and with special equipment. Some are acid-base compounds and are still experimental as far as the aircraft use is concerned, although they have been used widely for other types of transportation equipment.

The best source of information for approved cleaners is the manufacturers and fabricators of aluminum, such as the Aluminum Company of America and Reynolds Metals Company, both pioneers in fabricating for the aircraft industry. ALCOA reports that it has discontinued testing cleaners of aluminum due to the fact that many special compounds were tested and then the chemical formulas were changed, necessitating expensive and frequent re-testing.

Reynolds Metals Company's research division has tested general trade-marked preparations and 65 of the safe cleaners for all aluminum products are included in their Technical Service Bulletin No. 68. If you want this bulletin, write Reynolds Metals Company, at Richmond, Virginia.

Bearing out the fact that soap is still the safest and best, more than one-third of the approved cleaners on the Reynolds list are the familiar soap products in flake, chip, powder and bar form that are used in every household. The others include various mild cleaners developed originally for houseware, automotive and general metal uses. The fact that some cleaners are not listed does not mean that they are unsafe for aluminum, but in certain cases the cleaners may have not been included in this testing operation because of specialized uses or they are sold in bulk to companies which perform their own control testing before putting them to use. As a case in point, E. I. du Pont de Nemours reports that Du Pont Tranox, a water-soluble acid cleanser used on railway equipment, is now being experimentally tested for use by a large airline. It can probably never be used in small operations because of the care needed in handling and controls necessary in washing, due to its acid properties.

After using any general cleaner, whether soap or special compound, the plane's surface should be flushed repeatedly and thoroughly with clear water. If this is not done, streaking and gumming may result.

POLISHES. As with cleaners, various alu-

METAL AIRCRAFT or fabric . . . all planes require periodic cleaning and polishing. Good care of this type will keep maintenance bills low and will put higher re-sale value on plane

COATINGS such as Plasti-Clad or ReGlo will keep your plane's surface bright, shiny

minum or general metal polishes on the narket contain base compounds that may be njurious to aluminum surfaces over a peiod of time. Inspection of the label for conent and cautions in use is one method of letermining whether a special cleaner is safe for aluminum. Reynolds reports that Air Force-Navy Aeronautical Bulletin No. 359 ists as approved aluminum polishes for use on Air Force and Navy aircraft, the followng liquid type compounds meeting specification AN-P-88: 70625-A and 70739-A both made by R. M. Hollingshead Corp.; Formulas Nos. 13, 14 and 15, made by Noxon, Inc.; RX14755 and B-18535, made by Sherwin-Williams Co.; Minmum, Turco Metal-Glo and Turco LAC 1859, made by Turco Products, Inc.; and 3347X11-102, made by West Disinfecting Co. Paste-type aluminum polishes are not included in this bulletin.

PROTECTIVE COATINGS. After washing, aluminum, painted aluminum or fabric-coated surfaces should be allowed to dry thoroughly and then they may either be waxed to a high polish or coated with one of the new chemical compounds that have taken over the job formerly assumed by various lacquers, *i.e.* ReGlo, Plasti-Clad, etc.

All waxes used for polishing automobiles are eminently suitable for aircraft, whether liquid or paste types. Wax should normally be applied over otherwise unprotected aircraft surfaces to fill scratches, provide an attractive, highly polished finish and most important, provide buffer protection of the surface against the elements.

Perhaps one of the best examples of new type non-wax, non-lacquer protective coatings in ReGlo, manufactured by Regal Air Corporation of New York. It is a transparent, clear sprayed-on or brushed-on coating for all metal or fabric surfaces. According to the manufacturer it does not crack, peel, chip or discolor. It gives a "hand-rubbed" finish without rubbing, requires only periodic hosing or wiping with a damp cloth to clean, and one coat, it is said, will last a full year.

The chief pilot of Anaconda British Guiana Lines, Ltd., Harold Curtis, reports that a Grumman G-21A *Goose* based on an open ramp under the tropical sun and operated out of salt water, is kept in perfect condition with a ReGlo coating every four or five months. An Aeronca Champion float plane operated by the company in the interior of British Guiana, hangared and operated off fresh water, is also sprayed with ReGlo.

Another coating, this one a transparent plastic, is called Plasti-Clad and is put out by Metco Laboratories Corp., Indianapolis, Indiana. According to the maker, it forms a non-porous protective seal against corrosive effects of the weather and it does not chip, crack or peel.

Protective coatings of this type eliminate the need for waxes and also cut down on the amount of special polishing and cleaning needed on all types of aircraft to keep them clean and bright.

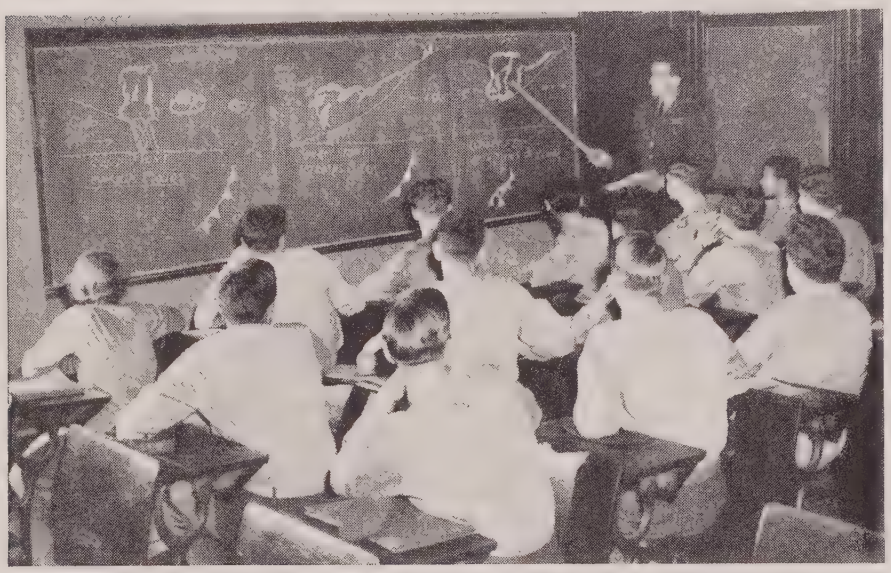
Adequate cleaning and polishing periods for aircraft will aid in eliminating unsightly stains, blemishes and possible deterioration of the aircraft surfaces. Fabric surfaces will last longer and painted aluminum will not fade or peel if cared for and protected. What's more, your plane is "worth more" in good condition, both to yourself and to any potential buyer should you want to sell.

SAFE ALUMINUM CLEANERS

Aluminum cleaners tabulated below were tested and approved by Reynolds Metals Company Research as indicated in Research Report #246. Alloy 3S-H14 was used in all tests.

Name	Description	Maker
Agiton	Liquid	Turco Prod., Inc., Los Angeles, Calif.
All Purpose Cleaner	Powder	Steelcote Mfg. Co., St. Louis, Mo.
Aluminum Cleaner	Powder	W. D. Carpenter Co., Syracuse, N. Y.
Arconomy Flakes	Flakes	Armour Co., Chicago, Ill.
Artic Syntex Beads	Powder	Colgate-Palmolive Co., Jersey City, N. J.
Auto Soap Flakes	Flakes	Green Oil Soap Co., Chicago, Ill.
Bright Sail	Powder	A & P Tea Co., New York, N. Y.
Brillo	Impregnated Pad	Brillo Mfg. Co., Brooklyn, N. Y.
Chipso	Chips	Procter & Gamble, Cincinnati, Ohio
Clenesco Chromated Cleaner	Liquid	Cowles Chem. Co., Cleveland, Ohio
Clepo 86-P	Liquid	Fred Gumm Chem. Co., Kearny, N. J.
Club Aluminum	Impregnated Pad	Club Aluminum Prod. Co., Chicago, Ill.
Cudahy's Famous Formula	Powder	Cudahy Packing Co., Chicago, Ill.
DC #36	Liquid	The Diversey Corp., Chicago, Ill.
Dexta	Powder	A. S. Boyle Co., Jersey City, N. J.
Diversey Triple A	Powder	Diversey Corp., Chicago, Ill.
Diversey SS Al. Cleaner	Powder	Diversey Corp., Chicago, Ill.
Duz	Powder	Colgate-Palmolive Co., Jersey City, N. J.
EX 1333	Liquid	Gerson-Stewart Corp., Cleveland, Ohio
Easytake Soap Chips	Chips	Hewitt Bros. Soap Co., Dayton, Ohio
Emcol 3177 Batch #106	Liquid	Emulsol Corp., Chicago, Ill.
Emcol 3178-S Batch #105	Liquid	Emulsol Corp., Chicago, Ill.
Emulsept	Liquid	Emulsol Corp., Chicago, Ill.
Fels Naptha Soap	Bar	Fels & Co., Philadelphia, Pa.
Grandma's Soap Chips	Chips	Procter & Gamble, Cincinnati, Ohio
Green Oil #7	Paste	Green Oil Soap Co., Chicago, Ill.
Guardian Service Cleaner	Powder	Century Metalcraft Corp., Los Angeles, Calif.
Houghton #50	Powder	E. F. Houghton Co., Philadelphia, Pa.
Kelite #1	Liquid	Kelite Prod., Inc., Los Angeles, Calif.
Kirk's Flake Soap	Bar	Jas. S. Kirk & Co., Chicago, Ill.
Klen-o-cide #3	Powder	Klen-o-cide Co., Chicago, Ill.
Milko-Stat	Liquid	Rex Corp., Burlington, Iowa
New England Cleaner	Paste	Hanson-Vanwinkle-Munning Co., Matawan, N. J.
Nielco 1923-T	Powder	Nielco Lab., Detroit, Michigan
Nu-Kleen Formula LC-11	Liquid	Klenzade Inc., Beloit, Wisconsin
Oakite Aviation Cleaner	Powder	Oakite Products Co., New York, N. Y.
Oakite #61	Liquid	Oakite Prod., Inc., New York, N. Y.
Olivesco	Powder	Cowles Detergent Co., Cleveland, Ohio
Oxydol	Powder	Procter & Gamble, Cincinnati, Ohio
Old Honesty Soap Chips	Chips	Falck & Co., Pittsburgh, Pa.
Pronto	Liquid	Pronto Chem. Co., Boston, Mass.
P & G White Naptha	Bar	Procter & Gamble, Cincinnati, Ohio
Q-59	Liquid	U. S. Sanitary Corp., New York, N. Y.
Quick Arrow Soap Chips	Chips	Swift & Co., Chicago, Ill.
Red-White Borax Soap	Bar	Wilson & Co., Chicago, Ill.
Rex Liquid Cleaner	Liquid	Rex Corp., Burlington, Iowa
Rex Milkstone Remover	Liquid	Rex Corp., Burlington, Iowa
Rex Special Liquid Cleaner	Liquid	Rex Corp., Burlington, Iowa
Rinso	Powder	Lever Bros., Cambridge, Mass.
Roccal	Liquid	Winthrop Chem. Co., New York, N. Y.
Selox	Powder	Procter & Gamble, Cincinnati, Ohio
SOS	Impregnated Pad	SOS Company, Chicago, Ill.
Sprex AC	Powder	Dubois Co., Cincinnati, Ohio
Steam-Aero	Powder	Turco Products Inc., Chicago, Ill.
Super Suds	Powder	Colgate-Palmolive Peet Co., Jersey City, N. J.
Triad B	Liquid	Detrex Corp., Detroit, Mich.
Turko Multiplex	Powder	Turko Prod., Inc., Los Angeles, Calif.
White Cap Soap Flakes	Powder	Armour & Co., Chicago, Ill.
White Crown Soap Chips	Flakes	Procter & Gamble, Cincinnati, Ohio
Whiz Airplane Cleaner	Liquid	R. M. Hollingshead Co., Camden, N. J.
Wyandotte Al. Cleaner 4X	Powder	J. B. Ford Sales Co., Wyandotte, Mich.
Wyandotte L.A. Cleaner #1	Powder	Wyandotte Chem. Co., Wyandotte, Mich.
Wyandotte Poma Cleaner	Powder	Wyandotte Chem. Co., Wyandotte, Mich.
XCEM #44	Powder	Magnuson Products Co., Brooklyn, N. Y.
1029-1 Cleaner	Liquid	Rex Corp., Burlington, Iowa

C.A.P. News from Hq.



CIVIL AIR PATROL CADETS of the Brooklyn (N.Y.) squadron receive extensive training in meteorology as part of their cadet program. Their instructor is an Air Force lieutenant

Breakfast Flight

Bethel, Ohio. One hundred Civil Air Patrol planes from a radius of 200 miles landed at Bethel Airport recently for a breakfast flight meet. Before landing, the planes winged over the town to give the local residents a view of more airplanes than many of them had ever before seen in the air at one time.

Top Brass Day

Fargo, N. Dak. The North Daota Wing enjoyed a gala "top brass" day recently when three U. S. Air Force Generals, including a former Chief of Staff, and a number of high-ranking CAP officers flew in from Washington to attend a wing dinner at Fargo. The group was on an inspection tour.

Duck Hunters

La Crosse, Wisconsin. Venturesome duck hunters who face the possibility of getting themselves lost in the swamp areas around La Crosse, can take some comfort from a recent simulated air search and rescue mission conducted by the La Crosse Squadron of CAP. With two local CAP men enacting the role of duck hunters lost in the swamp, the squadron located the "lost" comrades, landed their airplanes nearby, and gave first aid. The "hunters" were then flown out. Next to the airplanes, the most important item of equipment proved to be the two-way radio.

Mercy Mission

Portsmouth, Ohio. Portsmouth's CAP Squadron and the Red Cross teamed up to help airlift a Portsmouth woman to the bedside of her ailing husband in Dayton, Ohio. En route home from Panama, the Air Force man was stricken with a disease contracted in the Canal Zone and could not continue his trip home to Portsmouth. Instead, Civil Air Patrol Capt. E. E. DeAtley flew the airman's wife to her husband's bedside.

Insurance Policy

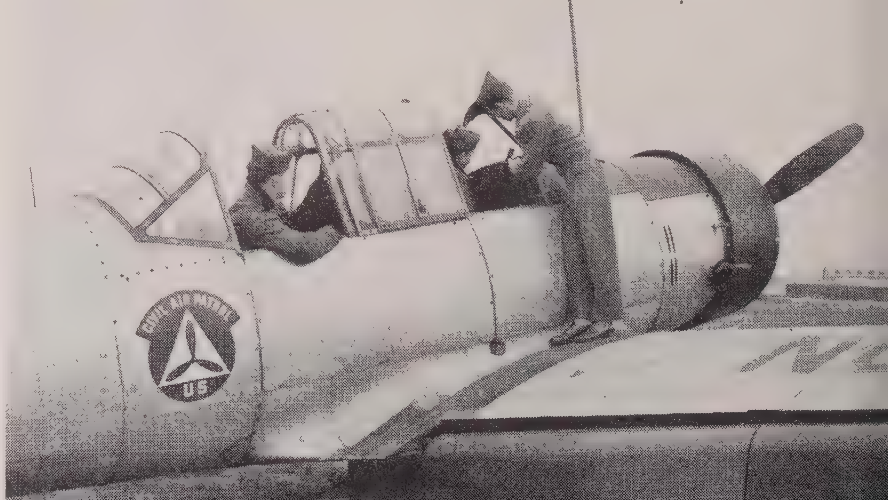
Phoenix, Arizona. For some time the Civil Air Patrol has been negotiating with various insurance companies to provide CAP members with a special aviation accident policy which would give them a complete and economical coverage while on Civil Air Patrol missions. Such a policy is now available through the Commercial Benefit Insurance Company of Phoenix, Arizona. The company is a Stock Casualty Company, has been thoroughly investigated and now approved by the National Executive Board of CAP. The policy provides benefits for loss of life, limb or sight, and indemnities for medical expenses and other payments incurred as a result of civil or Civil Air Patrol aviation accidents. It also offers world-wide airline coverage, and provides continental coverage for commercial, private and student pilots. Typical charges run: for $2,500 accidental death, $500 medical and hospital care, plus other policy benefits . . . $17, full year; $8.85, six months; $4.60, three months; and $1.55, one month. For further information, write L. T. Grimm, Mgr., Aeronautics Div., Commercial Benefit Insurance Company, Phoenix, Arizona.

Air Defense Maneuvers

Long Beach, Calif. In one of the first combined land-and-air civilian defense maneuvers undertaken by the CAP, 225 members of the Southern California division of the California Wing executed coordinated submarine patrol and air evacuation of VIP's and important documents from Long Beach.

In spite of unfavorable weather, between 30 and 40 private planes rendezvoused on the Long Beach Municipal Airport in response to summons from the Deputy Wing Hq's radio station on top of Look-Out Mountain. The drill presupposed a mock threat by "enemy" subs spotted by CAP planes.

On receipt of a "warning" that the subs were to attack within two hours, a caravan of 10 motor vehicles raced to City Hall where both VIP's and important documents were picked up. Behind a motorcycle escort the notables were rushed to the airport and out to waiting planes.



PRE-FLIGHT instruction includes airplane familiarization. Cadets get cockpit check as well as actual airplane and engine mechanics study. The plane is a war surplus trainer

CAOA REPORT . .

CORPORATION AIRCRAFT OWNERS ASSOCIATION, INC.

Corporation Aircraft Owners Association is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable corporation aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. The CAOA headquarters are located at 444 Madison Avenue, New York 22, N. Y.

New Members for CAOA

Applications which just missed the official directory for 1950 were received from Arthur Godfrey Productions, Inc. and Sperry Gyroscope Company. Both were accepted by Executive Committee and will be ratified at the next meeting of the directors.

Arthur Godfrey has a new postwar Beechcraft 18 and a Ryan *Navion*, based at Mallard Air Service, Teterboro Air Terminal.

The Sperry Gyroscope Company owns and operates three Douglas DC-3 aircraft, one of which is primarily for the corporation. The company also operates a DC-3, A-24 and Fairchild 24 for testing instruments under development. All are based at MacArthur Field, Sayville, Long Island.

Zero Readers for Executive Planes

George Weis, genial, sorrel-topped sales engineer for Sperry Gyroscope Company, has been given primary responsibility for developing the executive aircraft market for his company's products. He tells us that when the Zero Reader prototype first came out that Sperry officials were inclined to pooh-pooh the idea that corporation aircraft would be among those first to be equipped. However, orders on the line have a way of shouting down skepticism, and now George is busy making demonstrations, arranging for installations, etc. Quite a number have already been sold for executive aircraft, and by the time you read this Fuller Brush's *Mallard* will have been added to the list.

Mallard Air Service Opening

The opening ceremony of Mallard Air Service's new million-dollar hangar at Teterboro, N. J., was an outstanding success. Over 300 attended and were taken on guided tours through the extensive facilities now available to executive aircraft owners and operators. Luncheon was served in the room which has been set apart as an Operations Office and Conference Room for the Corporation Aircraft Owners Association. This deal was accepted at the last meeting of CAOA directors and details are being worked out.

Arthur Godfrey was master of ceremonies, and he tossed in a few kind words for our Association as a united and constructive force for the advancement of executive flying in the United States.

The CAOA office at Mallard Air Service is supplied with telephone, etc. The Exec. Sec. will spend some time there each week, and CAOA director John Dunham (United Cigar-Whelan Stores Twin-Beech pilot), member Bob Hewitt (president of MAS) and company pilots Shelby Maxwell (Burlington Mills), Neil Fulton (Mathieson Chemical) and others will help to keep things moving. Technical meetings and discussions for all company pilots and others are being planned.

CAOA in the News

It may interest our members to learn that during the week of December 4th the financial editor of the Associated Press processed a 700-word story on company-owned and operated aircraft which included much information about the Corporation Aircraft Owners Association. The story was used in newspapers throughout the country.

Also it may be noted that the February issue of *Dun's Review*, which reaches some 80,000 business executives, contains an extensive article on corporation aircraft operation, with several important references to the work of the CAOA.

Copies of either or both of these articles will be supplied upon request to the Executive Secretary at headquarters.

The Aircraft Industries Association has just published a booklet entitled *Plane Utility*, based on an extensive survey by the Personal Aircraft Council. In the booklet and in the December issue of the AIA bulletin PLANES, an introductory statement appears by William B. Belden, chairman of the CAOA Board of Directors, on utility in business flying today.

Welcome at SAC

Al Harting, Director of Public Relations of Southwest Airmotive Company is the fact that the petroleum industry more than a dozen years ago pioneered the use of executive planes and today is the greatest user of such transportation. The company is highly optimistic about the executive airplane because it has proved its utility as a new and valuable tool for industry.

Southwest Airmotive is presently one of the largest and most successful operations catering principally to the maintenance requirements of executive-type aircraft. In a typical month last summer nearly 700 executive planes, representing 34 states and four foreign countries, were "guests" there.

A major factor contributing to the success of Southwest Airmotive Company is the fact that the petroleum industry more than a dozen years ago pioneered the use of executive planes and today is the greatest user of such transportation. The company is highly optimistic about the executive airplane because it has proved its utility.

EXEC PILOTS' lounge at Southwest Airmotive's hangar in Dallas features ping-pong table, radio, etc. The new lounge is known as the "Eagles Nest"

CAOA Exec Secretary Silsbee is shown here greeting Burlington Mills pilot Maxwell at CAOA's office at Mallard

NOW...Gilfillan GCA in

GILFILLAN'S GCA CONSOLE in the L.A. control tower contains a surveillance scope (right), and two precision scopes for blind landings On the left is the three-mile final approach scope; in the center the 10-mile scope. Aircraft's position on final approach is shown in three dimensions accurate to ± 15 feet.

peration at L. A. Airport

DEDICATION of GCA at Los Angeles International Airport marks a great day for Gilfillan. It signals a long step forward n air navigation and safety. It is the realization of years of GCA research and development at Gilfillan.

Today, folks who fly the airlines to or from L. A. Airport can relax in a new assurance of safety...secure in the knowledge that the finest n air navigation equipment protects them.

A new surge of confidence in air travel will result. For with Gilfillan GCA, airline schedules will be regular and on time, delays and cancellations rare. Airline operating costs will go down, air safety up.

82 similar GCA installations will be made at key CAA airports by 1952. Gilfillan, in cooperation with the USAF, the USN, and the CAA, is proud to have pioneered and developed the GCA of 1950.

GCA Gilfillan
LOS ANGELES

Gilfillan's radar surveillance antenna (right), searching through 360°, scans a radius 30 miles out and 10,000 feet up. Position of every aircraft in a 2,800 sq. mi. area is picked up and shown on the surveillance scope.

Lightplane Mayday—GCA

(*Continued from page 23*)

"pip" being watched tells the ground operator whether the plane is making a proper approach to the runway. The CAA and Radio Technical Commission for Aeronautics prefer to call the close-in system Precision Beam Radar to differentiate it from Surveillance Radar which gives a controller a "picture" of all the aircraft in the general airport vicinity. It's the PBR that takes over for actual landing instructions. Together, the two radar systems make up a complete approach-control system.

In discussing the lightplane's use of GCA, one of the ground operators remarked that while it was possible to bring a lightplane in on a runway, he wouldn't guarantee expert performance all the time because of that unpredictable combination of plane, radio equipment and pilot ability. The operator added, however, that he could bring any halfway experienced lightplane pilot in to a position some 200 feet above the end of the runway if not actually down on the runway. The pilot, the operator advised, would then have to complete the landing on his own, visibility permitting, of course. Newer GCA equipment will enable the boys on the radar screens to bring lightplane pilots all the way in.

While the operator and I were discussing the private plane use of Ground Control Approach, Al Bennett and his safety observer had taken off from Mitchel Field and were flying to an area some 10 miles away, from which point GCA was to pick them up and then bring them "home" again.

The first pick-up of the Cessna was n.g. The nose-on view of the Cessna presented too small a target to accurately track on the radar screen. In addition, radio communication was interrupted several times by local interference. When Al flew the ship diagonal to the GCA beam, however, the boys in the shack picked up his "pip" on the screen and were finally able to re-establish radio contact. This contact was only spasmodically maintained, but it was enough to bring the Cessna in to a point about 150 feet above the end of the runway.

At no time during the flight was Al able to see the ground. As a matter of fact, when no blind flying hood could be found to fit the Cessna, Al himself solved the problem by moving the pilot's seat back and sitting in a not-too-comfortable position on the floor of the cabin, below the level of the instrument panel. To accurately test the feasibility of the private pilot's use of GCA, it was absolutely necessary to simulate blind flying conditions, and this position on the floor of the Cessna was the only answer.

To make certain the "success" of the first ride-in on GCA wasn't pure luck, Al went back out for another go at it. This time it was a little easier, due largely to the fact that Al was now more experienced in giving and receiving the required information to and from the GCA shack. GCA brought him in with scarcely a hitch.

Bennett's reactions to the test, however, makes one point clear, namely, while it is possible for any competent pilot who knows how to handle radio to be successfully brought in on GCA, it definitely is not practical nor is it recommended for planes equipped with only low-frequency radio. The static and interference on low-frequency reception is murderous on the ears, and the directions given by the GCA operators are not readable much of the time. According to Mr. Bennett's experience, if a pilot were caught in bad weather and he had only a low-frequency radio, the chances of GCA bringing him in successfully would be only about 50-50, and Al insists he's being generous in that ratio. VHF is necessary for good GCA operation.

One factor in favor of the lightplane use of GCA, however, is the slow speed of the plane. This time lag makes it easy for the lightplane pilot to query the GCA controller and correct his position with time to spare between orders.

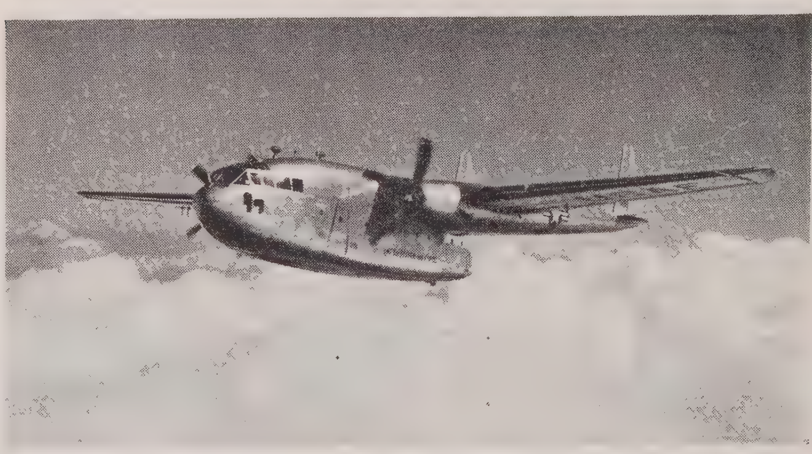
It must be stressed that military GCA is only an *emergency* measure for civilian lightplane pilots, and its existence should never be an excuse for any pilot to fly into marginal weather when on a VFR flight. It may save the life of a pilot lost in a haze, but it is not a standard method to be used to bail Dilberts out of tight spots.

To give pilots a general idea of the procedure followed when GCA control becomes necessary, the following information is based on a military regulation governing GCA assistance. As presented here it is unofficial and is merely intended as an aid in helping pilots understand the type of information GCA controllers may ask for or give during a flight. At all times a pilot *must* follow the directions of, and have available the information requested by, the controller.

Aircraft requesting GCA let-down at a base must get clearance from Air Traffic Control through the airport Approach Control. The plane should contact the airport tower or field radio and request GCA when it is at least 30 minutes from the base. The tower will then arrange the clearance from ATC and assign the working radio frequencies.

The GCA traffic director probably will ask

(*Continued on page 59*)



New Packet Joins USAF

This above-the-clouds cargo plane is the Fairchild C-119 *Packet* now entering service with the Air Force as a replacement for the famous Fairchild C-82 *Flying Boxcar*. The first two C-119's are now in use by the USAF troop carrier units at the Smyrna Air Force Base in Tennessee. Additional C-119's are coming off production lines at Fairchild. Offering added speed, payload and range over the older C-82, the new C-119 carries 42 fully equipped combat paratroopers as well as 20 500-pound containers of supplies. As a cargo carrier, it hauls up to 10 tons of load. The C-119 is powered by two Pratt and Whitney engines rated at 3250 hp at 1500 feet. The ship has top speed of 266 mph at 18000 feet.

Over the Overcast

(*Continued from page 19*)

finally had to let down through it . . . . . as long as he didn't wind up out of gas in the middle of Salt Lake where salt water at a near freezing temperature would be sure death in a minute's time.

Meanwhile on the ground we actually had about 800 feet at Ogden. It had been snowing a little in the last hour, but that had given up and the weather had settled down into a sulky, smoky, darkish haze. It was fairly late in the afternoon for an overcast day and the visibility was coming down to about two miles.

Several of us who knew this pilot aloft were there at the Ogden field, just loafing around wishing that better weather would hurry along. Nobody knew that he was coming in from the east, and he hadn't filed a flight plan.

He had a fair chance right then to spend the rest of the spring on the side of a mountain without a person even knowing that he was missing on his trip.

His chances were not more than 50-50 any way you want to look at them.

Yet, all he had done wrong was listen to a radio report instead of looking at the weather, and taking a chance on going up over an overcast against the prevalent headwinds he knew were there. Not a very grieviouus sin, was it?

After three and a half hours of flying, he was still at 17,000. It was now apparent that with no radio to clue him on his location he had to get down without instruments to position his flight attitude.

He did two extremely smart things. First, he decided to spin down, knowing that if he lost control in a power spiral he was a gone gosling; whereas he'd never put a critical tress on this ship in a spin. And,

(*Continued on page 52*)

500 Miles Up!

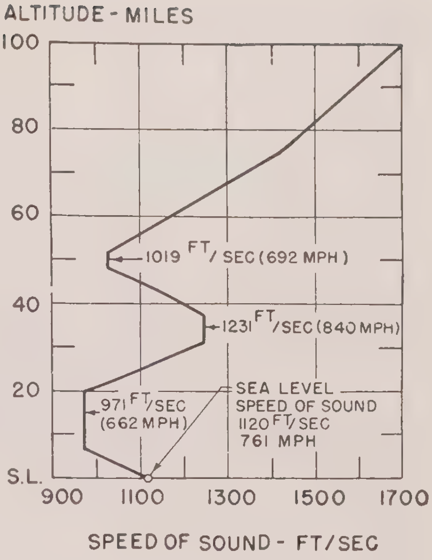
(*Continued from page 33*)

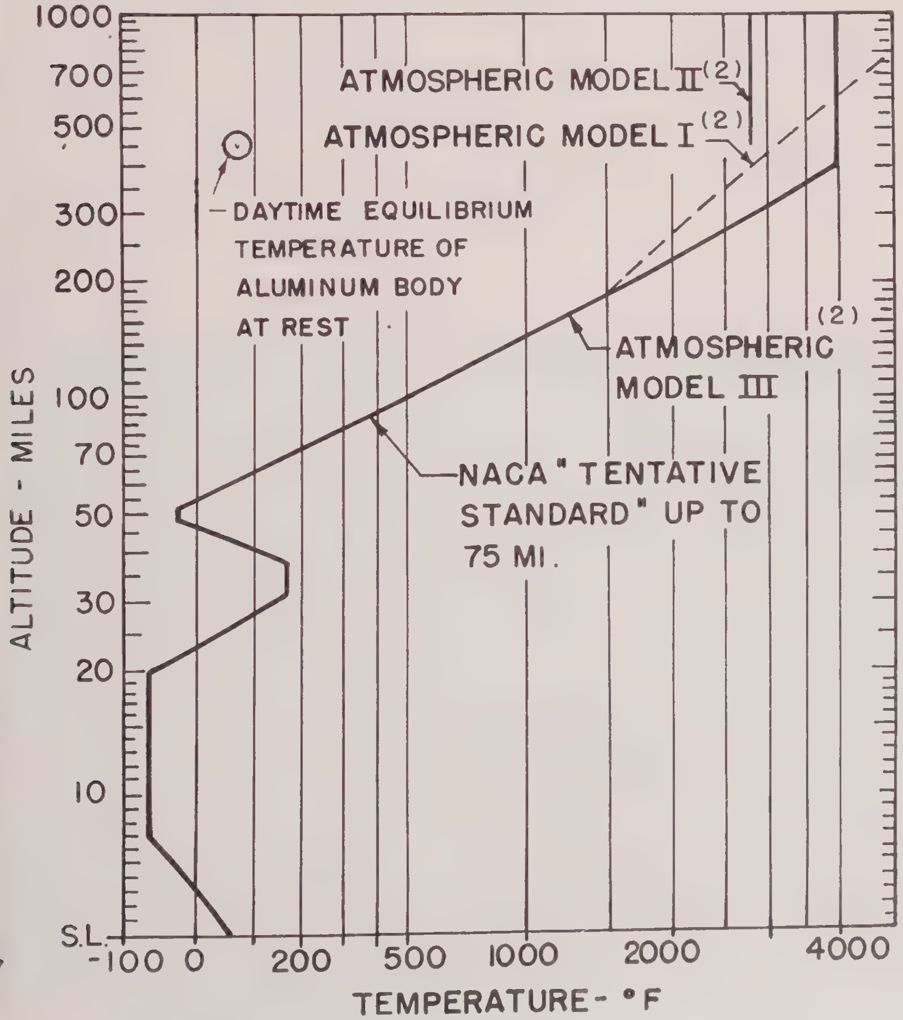
realization. After the first successful planetary escape rocket is fired, decades may pass before passengers will be carried in such vehicles. The planning of round trips to a planetary station such as the moon is further complicated by the fact that the *return* fuel must be carried in order to escape from the gravitational field of the planetary station. In short, the problem is not only to get man to the moon but also to bring him back. The speed that is required to escape from a planet depends on the mass of the planet, *i.e.*, its gravitational force. We know now that speeds of 25,000 mph and 5,300 mph are required to escape from the earth and moon, respectively.

Meteors present a potential hazard to satellite and space vehicles. G. Grimminger writing for the "*Journal of Applied Physics*" has considered the probability that a body will be hit by meteorites, and he shows that there is very little chance that a reasonably thick-skinned vehicle would be perforated by meteorites. However, the astronomical number of meteors which enter the earth's atmosphere each day must be considered as a *potential* hazard in spite of "probability" analyses. These meteors may be considered dangerous only at altitudes greater than those at which they disappear in their vaporizing descent into the atmosphere (35 to 50 miles). Although the average size of a meteor is somewhat smaller than a pea, they travel at such terrific speeds, up to 170,000 miles per hour, that *one* collision with a fair-sized meteor would be catastrophic.

It seems highly probable that the major part of travel will for some years be confined to the lower regions of the earth's atmosphere. The *average* characteristics of the earth's atmosphere have been presented by the NACA for use in connection with aeronautics. These characteristics are well known to all workers in this field. The characteristics which cause the greatest concern in air transportation are not the average characteristics of the atmosphere, but the deviations, *i.e.*, weather disturbances. Although the primary causes of weather disturbances in the earth's atmosphere originate within the troposphere, there are secondary causes which originate in the outer atmosphere. Meteorologists are, therefore, interested in the characteristics of the outer atmosphere and have supplemented the available information considerably through their numerous investigations. It is anticipated that in the future the average altitude of aircraft flights will increase considerably. As this situation develops, an accurate knowledge of the earth's upper atmospheric characteristics will be needed.

A scientific reader will find the means by which the atmospheric characteristics are determined as interesting as the characteristics themselves. Early theoretical determinations of atmospheric characteristics have been supplemented by modern experimental methods. Among others, the wartime developments in the fields of radar and radio communications have added great impetus to the program of atmospheric investigations. Some of the more important means which are used to investigate the character of the atmosphere are:





(a) Measurements by means of radiosondes (balloons) and rocketsondes (rockets). Data obtained from these sources include temperature, pressure, wind drift, and composition of the atmosphere above various stations throughout the world.

(b) Measurements obtained by means of aircraft. Much valuable meteorological data have been obtained by aircraft which are flown to high altitudes, into and around severe weather disturbances, and even on ordinary scheduled flights. The importance of data obtained from this source in the analyses and prediction of weather cannot be overemphasized.

(c) Measurements of the reflection of abnormal sounds by the atmosphere. Data thus obtained have been used to calculate the temperature distribution of the upper atmosphere.

(d) Spectrographic measurements of the light from the auroras. Spectrographic analyses of light from auroral displays have aided in establishing the chemical constituents present at the altitudes where they appear. The altitudes of the auroras are calculated, by triangulation, from stereoptic photographs taken simultaneously at two ground stations.

(e) Spectroscopic studies of the night sky light. Atmospheric luminescence exists in the night sky in addition to light from other souices. Studies of this light suggest the composition of the upper atmosphere.

(f) Study of the appearance, paths, and disappearance of meteors. Radar and phototheodolite tracking of meteors and their trails and a study of the altitudes at which they appear and disappear have established atmospheric temperatures, densities, and winds in the region of the atmosphere where meteors are visible.

(g) Measurements of the absorption and reflection of radio waves in the ionosphere. Much has been learned of the ionosphere structure and its variation in altitude with time of day, season, and latitude, by means of various techniques which employ radiowave reflection and absorption measurements.

(*Continued on page 46*)

Bellanca Cruisemaster

(*Continued from page 18*)

in this model). The leather inserts are across the back as well as the seat bases and other areas of rough wear. The upper sides of the cabin are upholstered in nylon whipcord (tan in this ship), and the lower side, extending clear up under the instrument panel, are completely done in genuine leather. At the junction of the nylon and leather, there is a thin chrome strip all around the sides. The cabin flooring is nylon carpeting throughout.

We climbed into the back seat to check for comfort and visibility. Sure enough, the grumbles from the six-foot-plus guys about cramped cabins had been heard and heeded! The cabin is now three inches higher, four inches wider, and six inches deeper (measured from instrument panel to back seat) than the preceding model.

As we stepped up front, we got the impression that the panel was a separate unit far enough in front of the pilot so that there is a large, unobstructed area in which to move around and operate freely—nothing to step over, trip over, or get snagged on.

The front seats are partitioned and adjustable in the manner of the airline or Pullman seat. The bases of the back-rests are secured in a notched metal track or rail. To come forward, we took hold of the back-seat, pulled it against our backs to desired position, and then leaned against it. This action settles the base into its corresponding notch. Gone are days of the "extra cushion!"

We got settled and checked the panel. Principled, thorough planning has gone into the compact unit. The location, placement, and prominence of all instruments, handles, levers, and switches is obviously the result of the designer's research into function, frequency of use, convenience (near to hand and eye), and possible emergency. With the exception of the chrome landing-gear lever (its handle is shaped like a wheel), the emergency gear-pump handle, and the chrome flap lever (shaped like a flap), which are located below the pilot's seat and slightly to the right, everything is up front. There is no casual outcropping of handles and levers here and there, no instrument is much below or above eye level, and nothing is too far away to be out of "good boarding-house reach."

The arc of the instrument panel is extended into a column arrangement on the left and right side of the cabin. On the left side, placed and well-spaced one under the other, are the engine primer, a plastic enclosed flap position indicator (not a line pointer but a substantial arrow), wobble pump, and ventilator. On the right side are the cabin-heat selector and fuse box, with the "spares" on the back of its door.

Reading from left to right, the top row of the panel proper contains a glove compartment, fuel gage, bank-and-turn indicator, and two small "windows," one under the other: the upper window red-lights the word "wheels up," the lower, when green-lighted, indicates the "Left wheel down." The Avigator radio occupies the central position in the panel row. Next are two more windows, the top indicates "Motor on," (referring to the engine-driven pump that actuates the gear and flaps), the lower says "Right wheel down;" then the engine instrument (fuel and oil temperature and pressure), and ammeter. Far right side has another glove compartment.

Second row includes an eight day Elgin electric clock, airspeed indicator, rate-of-climb, sensitive altimeter, manifold pressure gage, tachometer, and cylinder-head temperature gage.

The third row has the key-switch (key fits baggage compartment and cabin door as well as ignition), the electric starter, and a cigarette lighter. Below this, a horizontal plastic tube, housing a light for the electrical switches, seems to form a dividing line between the top and bottom halves of the panel. This light operates independently of the indirect panel lighting, which is rheostat-controlled. Printed in heavy black on the plastic tube are the names of the corresponding switches below: gas gage switch for both tanks, carburetor heat, parking brake, mixture, throttle, radio switch, navigation lights, landing lights, and master switch. Last row below contains the cowl-flap control, the rheostat for the landing lights, ash-tray, the rheostat for instrument lights, and the prop control. It sure sounds like a lot of panel, but its all there in front of you, well-labeled and easy to interpret. Standard equipment includes the rate group, bank-and-turn, rate-of-climb, sensitive altimeter, eight-day clock, and the radio. Space is also provided for what ever additional instruments the customer may desire.

The compass is mounted overhead and dead center. The tab control is overhead too, in the form of a chrome crank and pointer for nose-position change. The cabin dome-light switch is a toggle on the right side of the cabin. Fitted around it to look like a part of the design are three concentric chrome circles concealing the cabin radio speaker. The section from the instrument panel forward to the windshield is covered with nylon whipcord, cutting out all glare and reflection.

We fastened the Army-type safety belt, fired her up, and taxied up the grass apron to the runway, checking the controls as we went. Checking the aileron and elevator, we found that the wheel, a plastic bean-shaped job, in full-back position is still a good 14 inches away from you. The rudder, equipped with toe-brakes, worked easily. The visibility in ground operation is excellent. A glance on your side takes in the tail-section. Through the opposite back window you take in the horizontal stabilizer and tip fin on that side. The wide gear and steerable tail-wheel make for additionally smooth, stable, secure-feeling operation.

Closing the pilot's window (a movable section set in the large window), we went through a last-minute cockpit check, cleared,

CRUISEMASTER buyer gets his choice of props: either Hartzell selective fully controllable, or Aeromatic *(below)* with altitude control

and swung round into position. The day was brisk and cold and the field was whipped occasionally by a fair crosswind from the left. We advanced the throttle gradually and slowly at first, then opened her up. A little torque is experienced, but about the time you've corrected for it with a touch of rudder, you're off! Take-off gave us 2550 rpm, so we raised the gear and held it to maximum climb. At 95 mph, full throttle, we read 1600 feet per minute. The angle of climb is pretty steep at the maximum from the standpoint of visibility out front, so we assumed a normal climb of 1200 feet per minute—95 mph, at 2450 rpm and 26 inches.

We continued the climb, turned out over the bay area to put the *'Master* through its paces. Leveling off at 3,000 feet, we set the gages and trimmed for normal. At 2350 rpm and 24 inches, we indicated between 170 and 172 mph. Cruising along this way, we could check for general travel-comfort. Vibrationless, soundproof flight is sure a treat, and this ship provides it. Decibelmeter tests have not been run on the *Cruisemaster* as yet, but we'll bet it runs a low score.

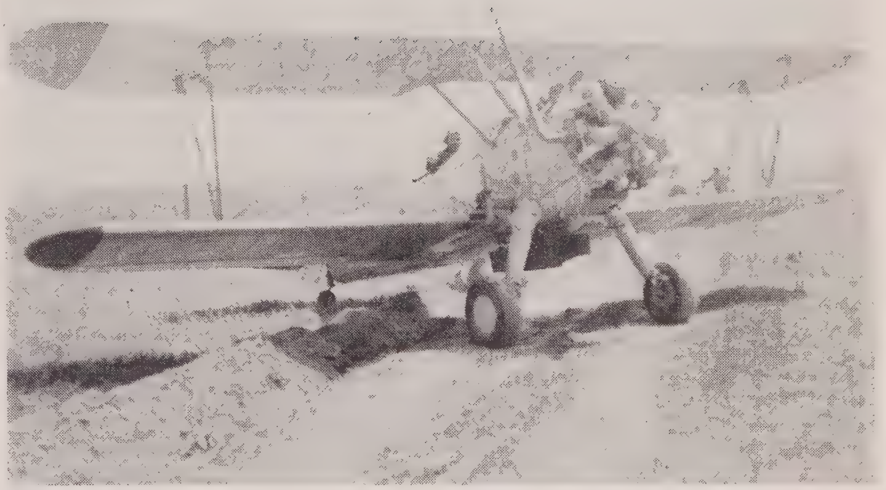
In checking the minimum and maximum action of the controls, you get the "feel" of this ship almost immediately. With ever-increasing angle of bank, we rolled the ship on a point 'til the wing was nearly vertical, then continued on around in steep 360's. There is immediate, smooth response of the controls with very little effort. As to aileron tension—you get exactly what you put into your turn—it is neither touchy, nor does it have any tendency toward over-play.

We cleared for slow-flight and stalls. Combining a check on gear operation and stalls with gear and flaps down, we throttled back to about 1600 rpm. (It is OK however, to lower the gear up to 167 mph). Let's talk about the gear, right here. Audibly, visually, and electrically, you are reminded of your gear position. Audibly, at 1600 rpm, a bell rings. It is a composite of all the tones of the telephone, the alarm clock, and the back-doorbell. Electrically, the *red* light on the panel operates for gear up, the *greens*, for each wheel down. Visually, a small metal spike about 3 or 4 inches long, which is attached to the top joint of the gear, pokes up out of the leading edge of the left wing when your gear is down. It disappears as the gear legs swing back into the wells, taking it along with it. (In other words, if you *don't* see it, you haven't got a gear!) To be any more convincing about getting your gear down, they'd have had to design a small arm to pop out of the side of the cabin and hit you over the head!

Gear and flaps down, throttle back a bit, the ship loses speed slowly. Slow-flight is stable and secure with both rudder and aileron action at between 50 and 55 mph. We pulled the nose up gently. Approaching, and right up to the stall, the ship is pretty maneuverable. With a lift coefficient of 3, it wants to hang on. It clocked 42 mph when the wing buffeted and the nose fell gently from its high position, and recovered. On the next one we released a little back pressure on the stick at the stall-break, and recovery of flying speed was immediate.

We raised the gear (permissible up to 124 mph), and ran through some climbing turn stalls, and a couple of power dives with pull-ups to stall position. No creaks, no groans, no change in the ship's well-knit construc-

(*Continued on page 50*)



CROP DUSTER walks home . . . almost. Duster made a forced landing in farmer's field not far from home airport, so he merely taxied out to road, rode the dusty road back to airport

Dawn to Dust

(*Continued from page 27*)

coffee down him the battle is as good as won.

After poking his head out of the door, he starts on the second cup while amiably cursing the weatherman for either providing too much or too little drift, whichever the case may be. Then out he goes to swap jokes with the other pilot and the boss while pulling on his flying gear. About this time the farmers and their hired men start arriving and the discussion is had as to which fields are to be dusted and in what order and direction. At this time some of the jokes are repeated for the growers benefit—Gad, I wish they'd tell some I haven't heard.

About five o'clock when the talk has died down and I'm trying to dose off again, the planes are started. This means a 15-minute ear-splitting engine concert in which the Continentals rattle the dishes and the *Wasp* groans in with a basso profundo to shake hell out of everything else. Much of the loading is done at outlying alfalfa fields, roads or cow pastures, but every morning there is at least one plane operating off of the home field.

Since crop dusting is one of the most dangerous of flying jobs, I can't help but listen for the sound of engine trouble, and I've learned to spot a 220 Continental or *Wasp* engine as far as the sound will carry, as well as notice any malfunctioning. One morning I was awakened by a sense of something wrong, and it was a few minutes before I could connect the sense of trouble with a sound. Sam had torn through the top of an oak tree and ripped several sparkplug wires loose on the Continental. He was 50 feet high and still about four miles away when I got out the door, but I could hear that engine missing even though I couldn't see the plane.

The boys have worked out a system of signals to warn people at the home field of any trouble they have had while dusting. Since the landing strip is only 1500 feet long and 60 feet wide a crippled landing could turn into a tragedy. In most cases the boys would rather attempt a landing here than fly into the big municipal field at Fresno. At least on the home field, if they do go over on their backs and burn, there is someone around who knows what to do and how to pull them out.

In three years the boys have brought back a varied assortment of telephone and power wires as well as good-sized tree limbs. One morning last spring Sam brought back 300 feet of copper coated steel telephone wire complete with insulators. That was the one morning I had managed to go back to sleep and didn't even hear him blip the throttle or know anything was going on until it was all over. He was flying a 220 Continental Stearman then and still had 600 pounds of highly inflammable sulphur dust in the hopper. I was told that he made a tricky landing coming in over an 11,000-volt power line at the end of the strip without touching it with the trailing wire. Later, when we were all sitting around drinking coffee, he was asked why he hadn't salvoed the load. He calmly replied that he had started to but found that he was still in the air and couldn't see any sense in dumping 50 dollars worth of dust without trying to save it.

A few days ago the company got a notice from the insurance agent that the workmen's compensation rate had gone up some 23½ per cent. This brought forth howls of indignation from everyone. Of course the premiums are paid by the company and this means that for every hundred dollars they pay the pilots, they also have to pay $23.50 for insurance. In three years of dusting the only claim on the insurance was a minor bill that came a few weeks ago when the other pilot had the only bad accident the company has ever had. He crashed in the river in one of the 220 Stearmans and walked or rather waded out of it with a slightly broken nose. The plane was a total washout or, as the boys would say, "rolled up in a ball." The salvage consisted of one aileron and part of the tail assembly.

For several years now there has been an advertisement running in some of the aviation trade papers exhorting pilots to buy one of their dusters and grab a slice of that heavy sugar. This has become a stock joke

(*Continued on page 50*)

500 Miles Up!

(Continued from page 43)

(h) Measurements of the solar spectrum from ascending rockets. Spectral photographs of the sun taken at various altitudes from an ascending rocket have given much useful information with respect to the changes in the composition of the atmosphere.

(i) Observations of the altitude and drift of noctilucent clouds. Studies of the noctilucent clouds, which are rare, night-visible clouds appearing at extremely high altitudes, have indicated temperatures and atmospheric wind velocities at the altitudes of these clouds.

(j) Analyses of transient variations of terrestrial magnetic elements. The magnetic field of the earth is found to vary regularly with time of day and season. Studies of these variations give information on the electrical conductivity of the ionosphere and probable winds in the upper atmosphere.

(k) Analysis of barometric fluctuations. Studies of the variation of barometric pressure indicate the presence in the upper atmosphere of world-wide wind systems which are caused by the atmospheric tide raising forces of the sun and moon.

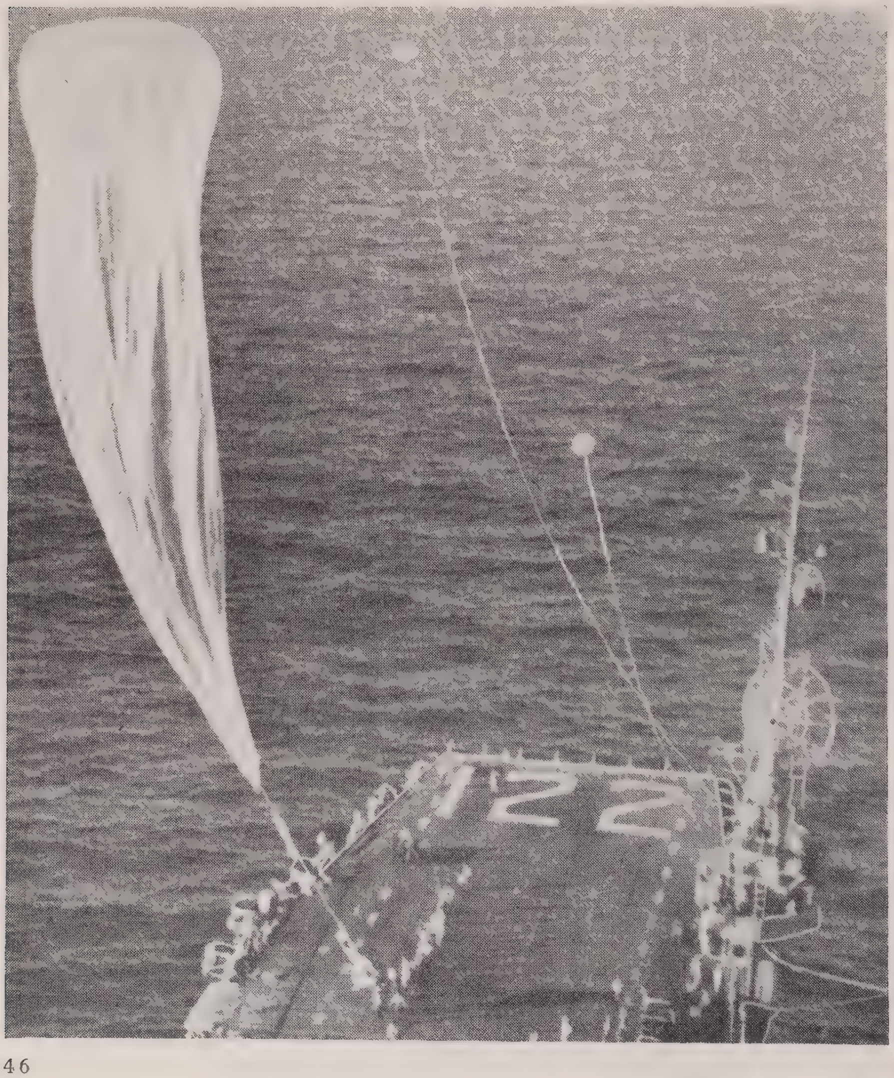
(l) Theoretical studies of the upper atmosphere. At extremely high altitudes, studies of the escape from the atmosphere of atmospheric gases, such as helium, indicate extremely high temperatures.

What ever was the sequence of events which transpired over two billion years ago when the earth's crust is supposed to have solidified, life as we know it on this planet was to find a relatively benevolent environment. The atmosphere which surrounds the planet Earth might, with any other sequence, have been extremely cold, extremely hot, or composed of noxious gases, as are the atmospheres of many of the other planets in the solar system.

These four layers which comprise the earth's atmosphere are not marked by sharp changes in characteristics. Instead, they are defined regions which are characterized by certain physical features. It is entirely possible that as more is learned about the atmosphere these regions may be re-defined.

Probably the most clearly defined layer is the troposphere. It is characterized by decreasing pressure and temperature with increasing altitude. At the uppermost limit of this layer, which is called the tropopause, an isothermal region begins which defines the lower limit of the stratosphere. The average height of the tropopause and the temperatures within the isothermal region vary with latitude. It is within the troposphere that all of the earth's weather disturbances are created.

OPERATION SKYHOOK—This balloon and 11 others were launched from carrier *Palau* to gather nuclear energy information. Balloon went to 97,000 feet. Instruments recorded data



The stratosphere is characterized by a temperature distribution, with increasing altitude, which is at first constant, then increases to a maximum, and then decreases. The maximum temperature (170° at 40 miles) occurs at the top of a concentrated region of ozone, which is sometimes called the ozonosphere. This region, which is several miles thick, absorbs a large part of the ultra-violet radiation from the sun. The pressure continuously decreases with increasing altitude through the stratosphere.

The ionosphere's upper and lower limits are subject to large diurnal (time of day) and seasonal variations. The temperature increases continuously through this region from approximately the freezing point of water at the lower levels of the ionosphere to the maximum value of 4,000°F at its upper limit.

The exosphere or "fringe" region is the outermost of the four layers surrounding the earth. The exact lower limit of the exosphere is not accurately known. Theoretical calculations indicate the probable lower limit lies between 300 and 600 miles up. There seems little doubt that the exosphere lower limit, like that of all other layers, is subject to diurnal, seasonal, and latitudinal variations. In this layer the number of particles per unit volume is so small and the particle mean free path so great that many outward-moving particles traveling at great speeds do not collide with other particles, as they do at lower altitudes, and hence are unretarded. These particles may rise to great heights in "free-flight," only to return to the earth's atmosphere again after several minutes. A few, however, actually escape from the earth's atmosphere altogether. There is strong evidence to indicate that helium and hydrogen atoms are continually escaping by this mechanism. Because of the "free-flight" motion of the particles, there is no sharp upper limit of the exosphere. Theory shows that the exosphere is an isothermal region.

At altitudes up to 50 miles, the atmosphere consists of approximately 80 percent molecular nitrogen, and 19 percent molecular oxygen. The remainder is made up of traces of argon, water vapor, carbon dioxide, and other gases. At altitudes of between 60 and 70 miles, the molecular oxygen dissociates, under the influence of solar radiation, to give atomic oxygen. Similarly, at somewhat greater altitudes (200 to 250 miles) molecular nitrogen is believed to dissociate into atomic nitrogen. In the regions up to 1,000 miles, as in the lower levels, there are apparently only traces of other gases, and over 99 percent of the gaseous mixture is composed of oxygen and nitrogen.

Very little is known experimentally of the composition of the atmosphere at the extreme altitudes of the upper ionosphere and exosphere. Physicist Grimminger has computed the atmospheric composition, based on certain assumptions, up to altitudes of 43,000 miles, and his computations show that it is possible that the atmosphere at extremely high altitudes is composed mainly of atomic hydrogen. It should be emphasized, however, that there are other, equally plausible assumptions, which may lead eventually to different conclusions.

A concentration of ozone, exists at altitudes of between 10 and 20 miles. Although the amount of ozone at these altitudes is extremely small, it is a very effective medium

(Continued on page 49)

Dollars & Sense in Exec Flying

(*Continued from page 21*)

in almost daily use by companies in more than 100 different lines of business. During 1948 business flying totaled more than a million and a quarter hours, representing at least 200 million airplane-miles and over half a billion passenger-miles.

Why all this business flying? The answer is a simple truth—companies with widely scattered interests have found that it *pays off* in dollars and cents. Many who have paid close attention to the facts and figures involved have reported that the use of their company airplanes has resulted in increased profits and reduced costs. Some have even insisted that, all things considered, it is the cheapest form of transportation they use.

To clearly understand this it is necessary to reduce the somewhat formidable annual dollar totals, and the rather appalling (at first glance) cost per flight-hour to a *cost per passenger-mile.* This is the proper basis for evaluating the cost of any type of travel, and it makes a good yardstick for a company's transportation department to use in figuring the relative advantages of rail, automobile, airline or company airplane in their over-all planning. In any given case, of course, it depends a lot on *who* is traveling, and *why*.

Top company executives who have to attend important conferences, sales managers who must make trips to district offices, manufacturing executives and engineers who must travel to branch plants, trouble-shooters with vital assignments that allow no time for travel—these and similar types of personnel need the fastest transportation available to get them direct to their destination and directly back (or on to another assignment) *anytime* they wish to go, without worrying about time-tables, airline schedules, stop overs, etc.

Coming back to this cost-per-passenger-mile yardstick, it should be emphasized that in comparing distances between two points you are often talking about two different miles. The rail-mile or road-mile cost frequently must be applied to a 15 to 25 per cent greater distance than the air-mile.

A good example of this is the short hop from Chicago to Detroit. This is a distance of 240 air miles, and the trip can be taken in one hour and 20 minutes in any of the twin jobs, or an hour and 30 minutes in *Bonanza*, Cessna or *Navion*—plus time to and from airports. Surface mileage, because of the jaunt around the lower end of Lake Michigan, is 283 miles by rail (seven hours), or 280 miles by U.S. Route 12, a trip which might easily run to eight or nine hours, point to point.

A better example is the longer trip from Chicago to Atlanta. This is 734 miles by rail (over 15 hours) and 725 miles over the road (at least two full days of fairly hard driving). It is only 580 miles by air (more than 25 per cent less), with three and a quarter hours in the plane, and a total point to point time of less than five hours.

Cole H. Morrow, Chief Plant Engineer of the J. I. Case Company and in charge of operations of the company's Twin Beech and Cessna 195, has figured that the average advantage for the country as a whole of air-miles over surface-miles is about 20 per cent. He always takes this into account in figuring up his statistics for the company aircraft rendered to the firm's transportation department.

On the general subject of economy for corporation aircraft operations he comments: "When the first company airplane was purchased in 1947 (a Beechcraft Model 18), it was assumed by all that airplane transportation was very expensive, and should be used only for special occasions. Our operating experience to date, however, shows that this is not true and that travel by air is the cheapest form of transportation we have, when all factors are considered.

"Up to the end of 1949, the company-owned planes had flown a ground equivalent of almost one million passenger miles at a total cost of about 8 cents per passenger mile. This cost includes such fixed charges as pilots' salaries, hangar rental, depreciation and insurance, as well as the direct operating costs of gasoline and oil, maintenance and other expenses in connection with the airplane.

"Without considering the many intangible advantages of company airplane transportation, the cost per passenger mile is competitive with other forms or transportation, and therefore the original assumption that airplane transportation is very expensive is not correct. (*Continued on page 48*)

Dollars and Sense

(*Continued from page 47*)

"Further analysis of our operating costs shows another fact that should be brought to light. The fixed charges amount to over 60 per cent of our total cost of owning and operating our two airplanes. These charges are incurred day by day and month by month without regard to how much the planes are used. The only costs which vary directly with the amount of usage of the aircraft are maintenance, gasoline and oil. This direct operating charge, based on present load factors, amounts to less than 3 cents per passenger mile, while the fixed charges are over 4 cents. Thus the additional cost to the company to make a trip by air is less than 3 cents per passenger mile more than if the airplane is not used at all. Therefore, in order to get the greatest benefit from the company-owned airplane, it should be used as much as possible."

This is a concrete example of the golden rule for economy in the operation of executive aircraft—a high degree of utilization.

How many hours per year should a company figure on using its airplane? Is there a break-even point which corresponds to the load-factor in airline operations?

As a general rule, for economical utilization executive airplanes should be operated from 400 to 500 hours (each) per year, or more. An average of 50 hours per month, or 600 hours per year is a good mark to shoot for; many companies get in more than this. An airplane on the ground is worse than a horse in the stable which consumes almost as much hay and oats whether it is properly worked or not. This is the main reason why a few companies have given up the use of an executive plane. These companies found that their planes had to sit on the ground for days at a time because, either through direct orders or tacit understanding, it always had to be at the beck and call of just the company president, and nobody else dared to use it. Fortunately, only a few companies ran afoul through this sort of misappropriation of airplane time, but its undersirable effect on operating costs should be emphasized.

This principle of high utilization for economy can be seen with startling clearness when the figures are plotted on a chart. The cost per flight-hour and cost per passenger-mile curves drop off very sharply from 100 hours per year to 400 hours, more gradually from 400 to 700 hours, and only slightly from 700 to 1,000 hours.

It's as simple as Fourth Grade arithmetic. The total annual cost of operation in dollars is the dividend; the total annual utilization in hours is the divisor; the bigger this divisor is, the smaller will be the quotient—the cost per flight-hour, or per passenger-mile.

We have checked with many companies which operate their own aircraft, and the following examples are typical.

Take a Ryan *Navion* or Beechcraft 35A *Bonanza*, selling for about $12,000 complete. Assume 600 hours per year utilization, with an employed pilot. The annual fixed charges would total $8600 (about $14 per flight hour) as follows: Pilot's salary, $5200 ($100 per week); hangar rent, $600 ($50 per month); insurance (all risk and crash, public liability, property damage and passenger liability), $900; depreciation, $1900 (engine, based on 4,000 hours of flying, $400; hull, five-year period, with 30 per cent residual value, $1500).

The direct operating costs, variable with usage, but based on 600 hours' flying would total about $5400, or $9 per flight hour. These include gas and oil, $2400 ($4 per hour); maintenance, $1800 ($3 per hour); landing and itinerant storage fees, pilot's expenses, etc., $1200 ($2 per hour).

Total cost for 600 hours utilization, $14,000, or $23 per flight hour. The fixed charges run to just over 60 per cent and direct operating costs just under 40 per cent ($8600 and $5400, as above). On the basis of 150 mph (including take-off and climb), total mileage for the year would be 90,000 miles. This works out to 15.5 cents per airplane-mile, and *5 cents per passenger-mile* (or 7.8 cents if an average of only two passengers is carried).

Costs on the Cessna 190 or 195 would be very slightly higher owing to the initial cost of $14,000 or $15,000, and higher fuel consumption of the radial engines. Maintenance costs, however, are no higher than for the flat-six type.

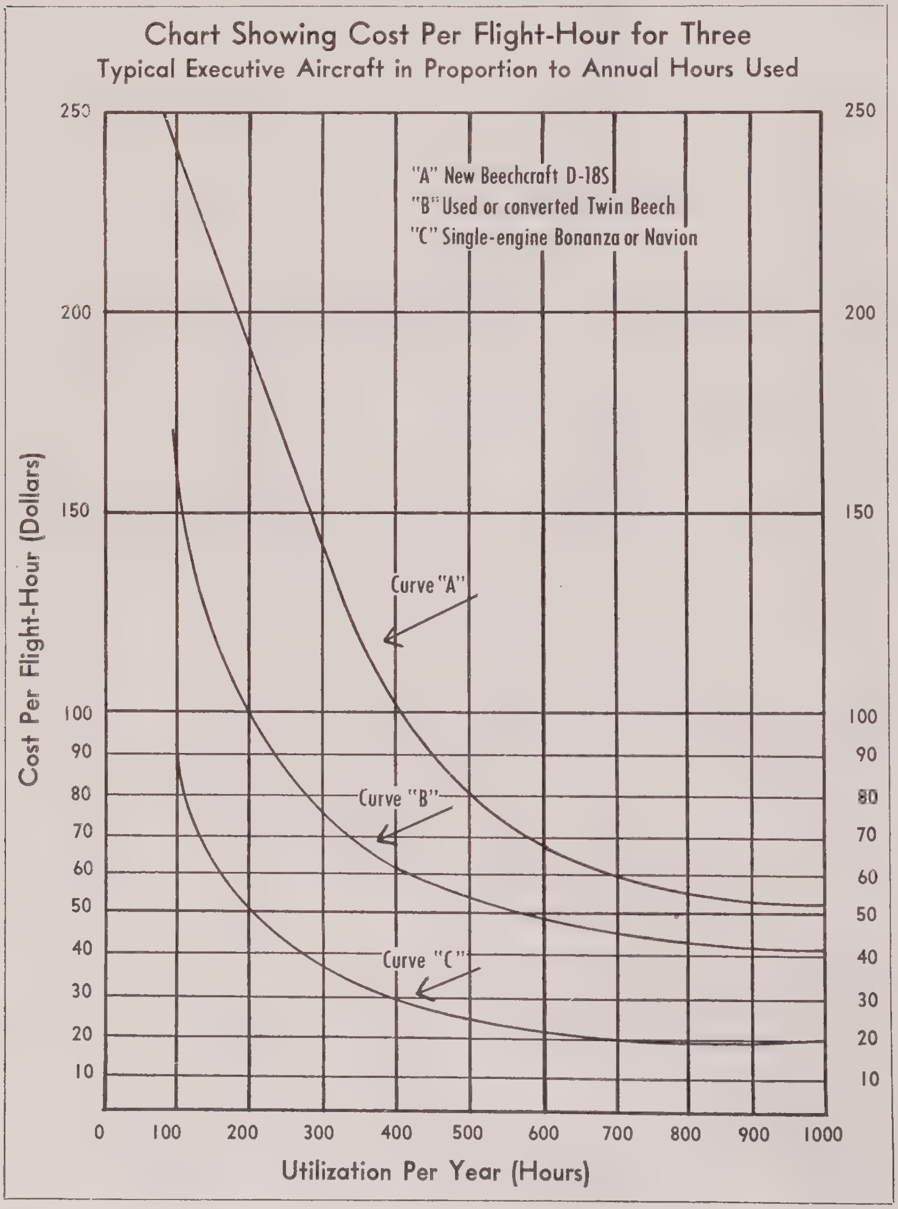
Relative figures on a new Beechcraft D-18S twin-engine job (P & W *Wasp Juniors*) are as follows: Assume original cost, including up-to-date radio equipment, $75,000, and average utilization of 600 hours per year.

Annual fixed charges would amount to about $24,000. These include pilot's salary, $6,000 ($500 per month); hangar rent, $1500 ($125 per month); insurance, $4200 (for $60,000 crash and ground coverage, $3600; liability and property damage, $600); depreciation, five-year basis, $12,300. This works out to $40 per hour for fixed charges.

Direct operating costs of flying service, $16,000 per year, or about $27 per flight hour. This includes gas and oil, $10,200 ($17 per hour); maintenance, $4200 ($7 per hour); pilot's expenses, landing fees, etc., $1600 (about $2.75 per hour).

The total cost for the year, based on 600 hours' utilization would thus be $40,000. As in the case of the *Bonanza*, the fixed charges are 60 per cent and the direct operating costs 40 per cent. Cost per flight-hour, $67. Based on an average of about 183 mph, total mileage for the year is 110,000 miles. Cost per airplane-mile, 36.3 cents. Cost per passenger-mile (4 passengers), 9.1 cents, or 12.1 cents for an average of three passengers.

(*Continued on page 63*)



500 Miles Up!

(*Continued from page 46*)

for absorbing solar ultra-violet radiation. This absorption of the ultra-violet radiation causes dissociation of oxygen from its molecular to its atomic form. Following this dissociation an atom and a molecule of oxygen combine to form ozone.

Oddly enough, Queen Victoria's funeral played an important part in the knowledge of the temperature of the upper atmosphere. In 1901, "minute guns" were fired in London as part of the funeral rites. The sound of these guns was alternately audible and inaudible in concentric zones around the source. At first this phenomenon was believed to be due to atmospheric winds. After various other theories were advanced and rejected, the theory that a high-temperature region exists at the 20 to 40 miles height became commonly accepted. Atmospheric reflections of sound waves originating from planned explosions have been carefully measured by systems of time-coordinated ground stations. Perhaps the most spectacular of these was the Helgoland explosion of 1947. Theory, applied to experimental measurements from this explosion, has yielded temperatures up to about 100 miles.

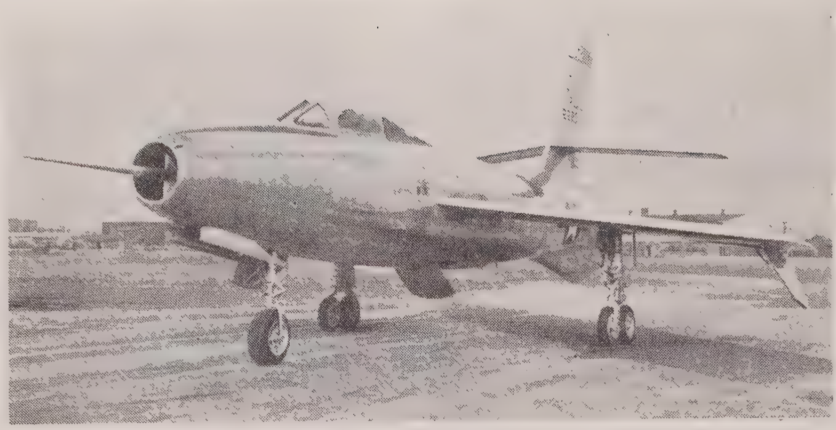
The existence of high temperatures in the upper atmosphere has been substantiated by rocketsonde and meteor measurements. The high temperatures at these levels coincide with the ozone layer. The ultra-violet absorption by ozone is believed to be the cause of the high temperatures.

There is a wealth of data on the temperatures in the troposphere and the lower stratosphere. These data are obtained from direct observations by balloon-borne radiosondes. They indicate that the average temperature within the troposphere shows an approximately linear decrease with increasing altitude to a minimum value at the bottom of the stratosphere (tropopause). This has been explained as the result of a rather complex process of radiation from the sun and earth and a vertical convection of the warmer air near to the earth's surface. The isothermal layer in the lower portion of the stratosphere is a region where there is an equality of radiation absorbed and emitted by the atmosphere. It is believed, therefore, that the marked vertical convection which exists within the troposphere is greatly diminished at the tropopause since there are no longer temperature gradients to cause it.

The gases of the atmosphere, under the influence of the earth's gravitational field, are compressed so that the densest regions are at the surface of the earth. The absolute pressure therefore, falls very rapidly at first with increasing altitude, and gradually approaches that of a complete vacuum in the outer limits of the atmosphere.

The speed of sound in the atmosphere is an important physical characteristic to aerodynamicists. The ratio of the speed of flight to the speed of sound is the well-known parameter, Mach Number. Within the troposphere, sound waves are propagated with very little loss in energy and at a velocity proportional to the square root of the absolute temperature. Strictly speaking, the velocity at which the sound wave travels is also a function of the wave length or frequency of the sound wave.

(*Continued on page 62*)



AIR FORCE'S high-altitude interceptor, the Republic XF-91, recently completed its initial tests at Edwards Air Force Base, Muroc. AJ-47 powers the XF-91

Dawn to Dust

(*Continued from page 45*)

around here, especially during the winter when there is nothing coming in. For a short period every year there's good money in crop dusting, there is, that is, if you compare it to the weekly salary of the average flight instructor. Sam's highest weekly check was $370 but the lowest was $4.50, with the average running around $200 for the dusting season. Here in California there are two seasons, one for insecticides and the other for cotton defoliation in the San Joaquin Valley. The insecticide season starts in May with the planes doing small jobs on orchards and vineyards and working into the cotton season in the later part of June. The defoliation season starts the last of September and runs until the first killing frost which is usually around the first of November. Incidentally, the word "frost" is *Verboten* within a mile of the hangar during the month of October. The explanation is simple: the boss starts out in the spring using red ink, breaks even during the summer and then, if conditions are right, he might make a little money in the fall. But an early frost could break him. A fine case of screaming hysterics can be induced by walking quietly up behind him and in a loud voice saying, "*Frost in the morning!*" A harmless practical joke like this has been known to cause the poor man to leave deep teeth marks in a steel propeller.

Getting back to the financial aspects of this business, the time for the annual vacation is between the two seasons. At this time the insecticide season has paid off last winter's accumulation of bills and everyone is dead certain that *this* year's defoliation will take us all through the winter without having to hunt up a job. So far our biggest vacation was a three-day fishing trip to Morro Bay, on which I got seasick before we even got to the harbor and consequently never set foot aboard the boat. Usually we end up in Los Angeles for a nice cheap visit with our relatives who are kind enough to feed us. However, this is bad as it subjects Sam to several weeks of sitting around with clenched teeth listening to my uninformed but well-meaning mother expound her theories on what would be an ideal career for him. The fact that he likes this type of flying is of little or no importance to her. Sam has never flown anything with more than one engine in his life, but no amount of patient explanation will convince her that he couldn't step right into the Captain's seat on a DC-6 *if* he really wanted to. The latest brilliant scheme consists of him getting on as an executive pilot with one of the major oil companies because she has heard somewhere they are offering fine opportunities to young men in Arabia. To her the pilot that dusts crops is the ditch digger of aviation and if he insists on frittering away his time in an airplane he should at least be flying the biggest and best available.

There is a sort of comrades-in-arms aspect to our little group. It might be called, "The Brotherhood and Fraternal Order Those Who Risk Their Fool Necks." It is a select lodge that not everyone can join. The pilot's wives become members only from association and then as a sort of women's auxiliary whose duties are to keep the log books and a constant supply of hot coffee on the stove. Some of this spirit seeps into the loaders who are high school boys and who give up opportunities for jobs that pay a lot more with better hours and easier work to take chances loading poisonous dusts just to be around the planes. They sweat out the ships much like the ground crews during the war. Only a week ago Sam's loader left an outlying strip expecting Sam to take off immediately to fly home. After George had left, another farmer drove up and wanted his field dusted. This made Sam nearly an hour late. Arriving back at the hangar, George waited and worried a while and then drove 20 miles back to the strip on his own time to make sure nothing had happened to Sam.

Although we eat beans in the winter and I have to keep house in a dinky trailer, I wouldn't trade with any other woman. Belonging to this fraternity, if only as an honorary member, makes me feel just a little superior to the woman who gets her husband off to work by eight o'clock and then forgets about him with her day's soap operas. I guess I'm spoiled by now as I'm used to having Sam sit and chat through a leisurely second breakfast and still not have to rush off to catch a bus. I may worry when I know he's dusting a tree-studded cotton patch and my nightmares have flaming airplanes in them, but when I watch him kick that Stearman around I can't help saying a little proudly, "Yes, sir, that's m'boy."

Bellanca Cruisemaster

(*Continued from page 45*)

tion characteristics. We clocked well over 200 mph on the last dive. (The ship is redlined at 226 mph, its nearest competitor, 202 mph.) The final power-on stall came through with earlier, more pronounced buffeting at 43 mph. We cut back on the throttle, glided down to 1200 feet. Trimmed for cruise again, she clocked 173 mph at 2350 rpm and 24 inches. Down over the water, in a low-level pass, we read 178 mph. The Vernier control on the Aeromatic prop for altitude-pitch adjustment, is operative when the control knob is "full in." The effect of pulling the knob out is to return the mechanism to "regular" prop operation. The full effect of the altitude-control mechanism is clearly seen where greater power is needed.

Just about the time we entered the pattern back at the field, a war-weary AT-6 racked it up on the downwind leg, so we throttled back, got the gear down and spaced ourselves behind him. It turned out to be a fairly long straight-in final approach. On the final we maintained a shallow glide, raised the flap lever till the indicator pointed "full" (46°), and came in the rest of the way at a normal glide of 65 mph. Gradually easing the nose up slightly, and dissipating the remaining speed, we greased her on. No waiting around for it to "happen," no floating, no sudden "selling out." We finished out the landing roll, raised the flaps, and taxied back for anothed take-off in a matter of seconds.

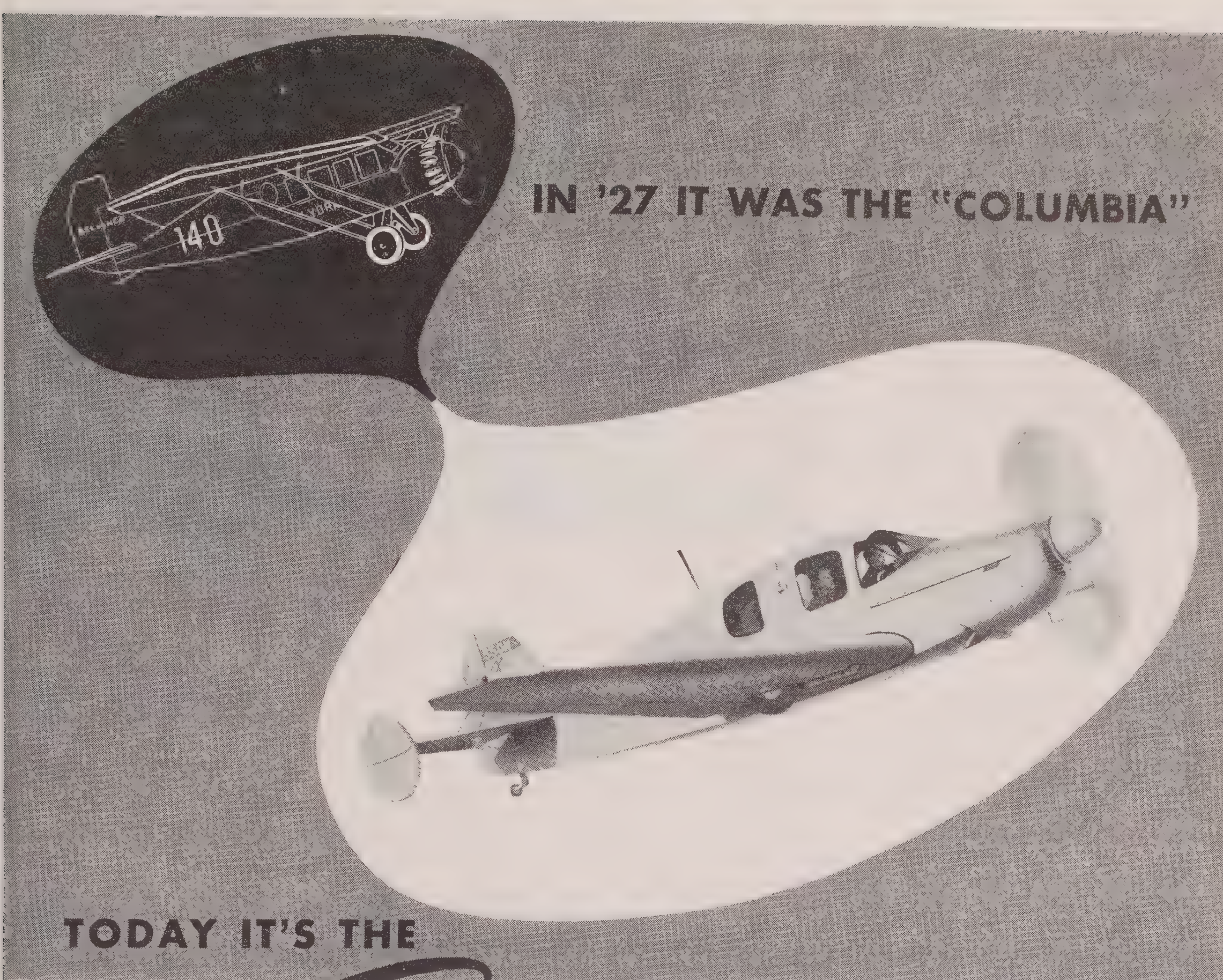
We speeded up the next circuit. Fed the throttle faster, pulled her off and up sooner. There's no wondering when and whether you're airborne in the *Cruisemaster*, no hanging there, no doubt about her taking hold. We raised the gear, held the steep climb to traffic altitude. We circled the field close in, got the gear on the downwind, flaps on the base, with plenty of time to plan the final. The visibility straight out over the nose is remarkable, right to point of touch-down. Then the ample coverage achieved from the side takes over. Makes you feel pretty good to repeat a good landing. Taxiing back to the hangar, we raised the flaps with a flip of the right heel. (As familiarity with the airplane increases, we'll bet this will become SOP for both gear and flaps.)

We were met with the usual "How did you like it?" and "What did you think of the performance?" We proceeded to enumerate the pet features that stuck with us: the clean design of the ship itself, the cockpit arrangement, the "gear-guarantee," and easy flight performance, plus the numerous extras that make it plushy. It's apparent that the hand that designed and built more record-breaking planes than any other in the industry, has not lost its skill!

Still to be added to the cockpit are the power-setting card for correct and most efficient prop operation, and the spin placard. Most four-placers are carrying them these days, though the pilot here says the *Cruisemaster* does a good normal one—in a one-turn spin—it'll recover hands off in a turn and a half.

The factory plans to turn out *Cruisemasters* in three colors—yellow, bright blue, and green—with harmonizing interiors.

Planned price? $9500. Let's see, if we turn in our car, camera, guns————!



Cruisemaster

Twenty-three years and thousands of airplanes ago, Bellanca triumphed with the "Columbia", made famous by Chamberlin and Levine in their flight to Eisleben, Germany. Today, Bellanca still holds the spotlight with the outstanding "Cruisemaster" —*the* executive airplane of 1950! The Bellanca Cruisemaster introduces sensational new safety features . . . new wide windows . . . new wide doors . . . new soundproofing . . . luxurious interior designed by Joanne Seybold!

The new safety features and the low landing speed of 43 miles per hour make the Cruisemaster the ideal airplane for either the novice or the veteran—for business or pleasure—for short field operation or spacious airports. A cross country cruising speed of 180 miles per hour makes distant points only a few hours away.

BELLANCA CRUISEMASTERS ARE DELIVERED WITH THIS STANDARD EQUIPMENT AND ARE AVAILABLE IN SEVERAL PLEASING INTERIOR COLOR COMBINATIONS.

Lycoming 190 engine—2-way VHF, plus the low frequency band—automatic hydraulic landing gear and flap mechanism —full controllable Hartzell Propellor—navigation lights—standard edge instrument lights—spacious baggage compartment—chrome grill and strips.

PERFORMANCE

Stalling speed 43 MPH—Cruising speed 180 MPH from sea level to 8500 feet at full gross load. (This Lycoming engine is the only aircraft engine that has no operating restrictions.) Short field operation facilitated.

WEIGHTS

Weight empty 1525, Gross Weight 2600, Useful Load 1075.

BELLANCA
AIRCRAFT CORPORATION
NEW CASTLE, DELAWARE

AT HOME IN THE AIR

Over the Overcast

(Continued from page 42)

he had resolution enough to figure that it would be best to have a live engine with a few drops of gas, then to just go on waiting for nature to take its course.

He didn't know if the tops of the mountains were only a few thousand feet below him or if he was out above a valley. It was a blind-man's bluff fully as fraught with peril as Russian Roulette.

He pulled on the carb heat control, set the throttle about 800 rpms and tightened the vernier down. Then he pulled up the nose, flipped the plane into a spin, made sure it was spinning properly while he still had a visual reference, and then concentrated on maintaining the controls in the exact same position, while he stared out the window watching for what he hoped would not be his last glimpse of the ground.

That was at 17,000 feet above sea level. He hit the clouds instantly. I've noted already that we had an 800-foot ceiling at Ogden, 4450 feet above sea level. That means he spun down into increasing darkness from the bright sun above, through nearly 12,000 feet of solid overcast.

He broke out over a little hamlet called Plain City, about 12 miles northwest of the Ogden airport.

He started his recovery the instant he saw the earth, recognized his position as he flared out about 400 feet high, and put his nose directly on course for the field.

The engine was still running, for he had methodically and regularly opened the throttle to keep the plugs from fouling.

The gas boy came into the hangar and said, "I hear an airplane."

Not believing it, we walked outside and soon spotted the ship coming in low from the northwest. He knew there wasn't any traffic, so came straight in. It was quite a distance across the field, but we could tell that he landed on the first 300 feet of the runway and then we noticed that the ship was stopped.

We drove a service car out there and found my friend looking, as I said, very perturbed and uncommunicative. In fact his face was white. The engine had stopped because it was out of gas.

Not much was said then, but a couple of years later when he told me where he came from that day, he added, "You know, I'd flown long enough then to know better than that. But it was kind of like being roped along by some charm. You try hopping over a few clouds and it works. So, you try it again. Finally when the weather is pretty damn good, you go a hundred miles over storm and break out CAVU. Then you try it when things are just a bit more marginal. If you don't get scared badly somewhere along the line, you wind up where I did . . . .

"No flight plan—we'd have frozen to death if I had made a crash landing in the mountains—which means we'd have been out a week or more before they missed us. No real certainty that the weather was getting better—in fact I knew the stuff was bad and could easily get worse.

"And, no parachutes, then no radio reception because of static . . .

"But, by God, I'll never do that again, believe me!"

TEST PILOT assigned to the Convair XF-92 is Bill Martin, shown here in cockpit talking to XF-92A's project engineer Thomas M. Hemphill. Pilot Martin flew the ship in tests at Muroc

Jet Interceptor XF-92

(Continued from page 14)

the top floor of Convair's windowless business office adjoining the San Diego factory.

"This airplane has had a lot of wind-tunnel testing," explained Engineer Hemphill. "We put the complete airplane in a wind tunnel at Moffett Field for final checks before it was taken to the Muroc Air Force Base for actual flight."

Two different powerplants were used in the 92-A. The original unit put out only enough thrust for high-speed taxi tests and short hop-skip-and-jump runs a few feet above the broad Muroc dry lake.

"The general policy of these skipping flights is frowned upon in testing, but they were all we could do until a new engine arrived," explained Shannon.

With the installation of the present J-33-A-23 powerplant, the "flying wedge" has completed nearly 80 test flights at Muroc. A number of qualified pilots on the base, including Captain Charles "Chuck" Yeager of XS-1 fame, have flown the radically designed ship without difficulty.

First flight honors, however, go to Sam Shannon of Convair. The original hop lasted about 30 minutes and "was just like any other first flight," according to the pilot. "As soon as you get off the ground, you start trying to find out how to get the airplane back down again. I took the 92-A upstairs to about 12,000 feet and checked her slow-flight characteristics. When it seemed to handle well at landing speeds, I came down and landed."

How does flying the delta wing differ from a conventional jet fighter?

In reply, Pilot Shannon answered that "it isn't much different. Actually, I'm more at home in a big airplane, and the little 92-A is somewhat out of my line, but in flying any prototype airplane, you look for things that should be improved. If you bought yourself a new Stinson, you'd just go up and have fun, but I don't recommend the 92-A for any 50-hour *Cub* or Stinson pilot. However, any F-80 or F-86 pilot could fly it with ease.

"The most unusual thing about flying the delta wing is the high angle of attack required for take-off and landing. Actually, the ship is very easy to land because there is so much ground cushioning effect."

From the cockpit, Pilot Shannon says that only a little of the wing's leading edge is visible, "but that's all you can see of what is coming along behind you."

Marginal forward visibility at the extremely nose-high angles of landing will be improved with a forthcoming cockpit modification. Some research planes are tailor-made around pint-sized pilots, but there is so much room in the delta's cockpit that Capt. Yeager said "you've really fitted yourselves up in comfort."

The cockpit had to be ample because Test Pilot Shannon is six feet tall. At 41, he is top test pilot for Convair. His background includes 20 years of flying, much of it test work at the Martin factory where he flew the old B-10 and several large flying boats. At Convair he worked on the *Liberator*, the *Dominator* and the L-13. He has logged over 4,000 hours, all told.

This first delta wing was built strictly as an experimental flying test model, not as the prototype of any particular aircraft. Research data collected from test flights on this "mock up," however, make Convair officials believe that the delta wing program should be continued by the Air Force because the original "flying wedge" has showed such high promise in subsonic and transsonic flights.

As long ago as last June, Convair's Vice President in charge of engineering, R. C. Sebold, said "research to date points to the possibility that the delta wing will develop into the standard configuration for supersonic flight."

Since this delta ship was built on a low-cost budget, many parts were scavenged from already existing planes. The hydraulic system was modified from an F-80 and the main landing gear is from the same ship. The nose wheel assembly is from a Bell jet. The control stick and brake cylinders are from an old surplus BT-13, while the tail pipe for the jet engine was modified from the Convair-built XP-81, a wartime jet-and-prop driven model.

Engineer Hemphill believes that the delta design would also make a good bomber,

but would not be particularly economical for a high-speed transport.

Extreme maneuverability is one of the strongest selling points of this new design. Even at high Mach numbers, Engineer Hemphill explained, the "flying wedge" could be turned to the full extent of its controls. A fully hydraulic system has been installed with a one-way lock so that no "feed-back" of vibration or flutter can be felt by the pilot. Then a mechanical "feel" was built into the system to give the pilot stick forces comparable to a conventional subsonic aircraft.

In delta construction, tail sections are eliminated by the use of "elevons" for ailerons and elevators. These "elevons" form the trailing edge of the delta wing. Directional control and stability are provided by a triangle-shaped vertical stabilizer and rudder. The tip of the tail is 18 feet above the ground.

Ease of construction is another sélling point in favor of delta wing construction. Aside from having fewer moving parts—no stabilizer or ailerons, no slots or flaps—the new configuration is easier to build to the high-strength requirements of transsonic aircraft. Short, stubby wings are naturally easier to build with sufficient "beef" than longer, sweptback wings.

When the delta wing was first taken to the Air Force testing ground at Muroc, there were a few comments of "What is it?" "What makes you think it will fly?" And . . . "Did the designer of that ship quit school in the third grade?" However, the "Buck Rogers Boys" at Muroc have become quite familiar with unusual aircraft and the "flying wedge" was just another test project.

The eight-mile table-top surface of Muroc dry lake is an ideal testing spot for these high-speed aircraft. "That big dry lake gives a test pilot a good sense of security," said Shannon. He cautiously admitted that the delta wing "can be landed slower than I have landed the Convair '240' transport in test flights," but for security reasons, he was reluctant to give any actual landing speeds of the new aircraft.

Exact landing speeds are not only unavailable for security reasons but also because of the difficult instrumentation problem involved. With the nose of the "flying wedge" pulled up to angles approaching 35° above level, none of the airspeed instruments read correctly. It is almost impossible to follow the delta wing at very slow speeds because, as Engineer Hemphill puts it, "the ship is coming down like the devil."

At first, a restriction of 10 landings per set of tires was imposed. After continued flights, however, this ban was lifted because of the easy landing characteristics of the delta due to ground cushioning.

As in nearly all transsonic aircraft, the landing gear of the 92-A is quite narrow. This narrow tread is necessary from the basic design standpoint because the wings on these high-speed aircraft are too thin to house a retractable landing gear. Therefore, the wheels must tuck into the fuselage.

When spectators commented on the similarity of the delta wing to the simple paper-model airplane of school-room days, Engineer Hemphill hastened to point out that the delta would fly equally well with the rudder and fin on the bottom of the fuselage—just like the paper model. The only difficulty in putting the rudder on the bottom of the fuselage comes in getting the landing gear long enough for a normal landing. As it is, the XF-92A has a stubby fin on the bottom of the fuselage.

Actually, the biggest headache on this new model was found in the extreme sensitivity of control. "This ship will slow roll a hell of a lot faster than an F-80 or F-86," said one test pilot.

Since the ship was first flown, the control movements have been cut nearly one half and the delta wing is still "the most maneuverable plane that has yet been built," according to Engineer Hemphill.

Convair officials are looking for a name for this new configuration. It looks something like a youngster's dart, but that name was used on a prewar private plane. Delta is also the name of a southern airline. Perhaps, "The Flying Wedge" might make a satisfactory name for this new ship.

With such satisfactory preliminary tests, the obvious question is—"Why wasn't the delta wing built sooner?"

Engineer Hemphill explained that the plane was built for the specific purpose of obtaining flight information on the radically swept triangle wing, and that although study of this design has been in progress for some time, "we are thinking now in terms of its operational possibilities."

Fifty years later, the "flying wedge" of football may well be the shape of supersonic aircraft yet to come.

Hell in the Cockpit

(*Continued from page 25*)

Clambake was hanging on for dear life, his eyes were slits trying to peer through the rain-streaked windshield, a frantic effort to pierce the torrential downpour to see something called land and home.

"Gear down," I screamed to him through the roar of engines, wind, rain and thunder. "We'll make it . . ."

Clambake jumped to the gear selector, jammed it down. It jumped back. He jammed it down again. It wouldn't stay.

"A swell time to give me an argument," he groaned as he hit the gear switch a third time. "The damn thing won't go down, Hank. If those monkeys that work on airplanes knew their . . ."

He hit the switch again. No luck.

I was just about to add my comments to his when I caught a glimpse of the airspeed indicator. The needle wavered at 110 knots. I shoved the yoke away from me as if it were the Admiral's girl friend at a squadron party. The devil with the beam and the landing gear! Since, apparently, we were about to spin it didn't matter. The altimeter began to unwind, but the airspeed stayed down!

"Ice on the pitot," I yelled, "turn on the heater." Clambake fell on the switch. Gradually the airspeed picked up, and I started back for the beam. If only the wheels . . .

Clambake tapped me on the shoulder, and I switched to interphone.

"Number two prop's running away," he called over, "overspeeding like crazy."

A look at Clambake proved he wasn't foolin' . . . the perspiration was running off him as he pointed a finger at the tachometer.

The plane lurched to starboard.

"Fix it!" I yelled back at him, "I got enough to do holding this lug on course without . . ."

Before I could finish, Pete leaned forward and acidly remarked, "The prop control circuit breaker is on your side, sir."

I felt along the circuit breaker panel until I found the errant switch. The prop settled down . . . and I began to wonder why an innocuous routine familiarization flight had to end like a mission over enemy territory.

"We oughta be over the fan marker soon," I groaned, more in prayerful hope than fact.

Clambake didn't even have time to answer.

"Fuel pressure's falling, number one," he called, "number two and . . ."

"Oil temp dropping, rpms and pressure, number three and four," Pete cut in. "No fuel flow, number one!"

I looked around wildly. The airspeed and rate-of-climb indicators were normal . . . non-electrical instruments functioning okay. Maybe . . .

"Try number two inverter . . ."

Clambake flicked the switch and the gages hopped back to their normal positions.

"D . . . . .," I screamed angrily, "doesn't anything on this aerial jalopy work smoothly. Get on that landing gear again . . ."

The rate-of-climb indicator began to drop. In a frenzied daze, I watched it go . . . five hundred feet . . . six hundred feet a minute. Down. I wound in back tab. The airspeed dropped dangerously. I called for 40 inches. It wasn't enough. Ice, I thought hopelessly. On top of everything else we were picking up ice! Then the cockpit lights went out, an engine coughed hollowly and died . . .

TRAINER OPERATOR Ernest Kaulens, USN, compounds the pilot's troubles on simulated flights in the *Privateer* trainer. Clarence Arndt runs the radio desk that fouls up the radio operator

I stuttered . . . I grabbed for switches . . . I wrestled the yoke with clammy hands. I cursed and sweated. In my earphones there was nothing but static. Then suddenly through it all came the welcome beat of the on-course signal. At last we had hit the low cone. I relaxed in relief.

"What now, Lindbergh?" Clambake asked as he slumped back into the seat.

"Switch to alternate air . . . ," I began, "Wing heat on . . ."

"Feather number three," suggested the Chief in a tone that belied his wariness of pilots.

"Feather number three," I repeated. "Number three low rpm, number three cowl flaps closed. One, two and four, auto rich . . . number three idle cut-off. Gas and generator off number three . . . switch off, number three."

The cockpit lights flickered, and the crazy little airplane settled down on the gyro horizon. The airspeed steadied. The storm was easing up . . . and the plane too. I began feeling a little better, but there was still that landing gear.

Came a flash of inspiration.

"Crank down the gear from the bomb bay," I called to the Chief.

Pete grunted something that sounded like "I wondered when you'd think of that," then turned and disappeared down the flight deck.

I called the tower and cleared for a landing. We came in okay, taxied to the hangar apron and I cut the engines. Wearily we dragged ourselves along the flight deck, down a ladder. We were on the ground again . . . and to me it never seemed so good.

We were on the ground . . . the ground floor, that is, in a room crowded with electronic equipment and technicians. I blinked stupidly in the light, trying to bring myself back to reality.

During the whole nightmarish flight I had been sitting just 30 feet from this room. Grinning up at me now was the man responsible for all of my troubles—a fellow in Navy blues, wearing on his left sleeve the insignia of a First Class Training Deviceman. Sitting at his desk behind a battery of instruments, flipping switches, listening in on the conversation in the cockpit, and doubling as the Tower Operator in radio transmissions, he was the PB4Y Trainer Operator, the last link in a fiendish scheme of pilot training; the contact man in a set-up that surpassed in realism anything I had ever experienced.

"Say," I said bitterly. "You forgot to make the wings fall off. What's the matter? You getting soft?"

"The Operator laughed. "How'd you like it?"

"Very rough," I said. "Very, very rough. How they can make a mock-up do the things that did, I'll never know."

"Here's the man who can tell you," said the Operator. "George Sperry, of Western Electric. He's in charge of maintenance and knows the Trainer like he'd invented it."

If he'd had anything to do with inventing

the device, Mr. Sperry should have been carrying a pitchfork and wearing horns. On the contrary, however, he was a mild looking gentleman with a gleam of humor in his eyes. He laughed and jerked his thumb toward the Trainer.

"It's quite a gadget, all right. It's more than a mock-up or an instrument trainer. Its real purpose is to train pilots and crews in emergency procedures. We can simulate serious emergencies here every day, emergencies that you can't practice in the air because they're too dangerous, emergencies that could nevertheless occur in the air at any time. We duplicate them under the worst possible circumstances—night flights on instruments, in rough air or under icing conditions—just about anything we want."

Mr. Sperry went on:

"The Trainer was built by Western Electric for the Navy." He pointed down the long corridors, lined with relays, tubes and switches. "There are several hundred miles of wires in this set-up, thousands of relays and switches. Essentially, the guts of the device are the computors for solving the problems of flight. We solve the flight equation by using an electric motor for each of the factors affecting flight: engine horse power feeding into thrust—thrust being divided into its components: angle of attack, airspeed, and rate of climb. Fundamentally, that's how the Trainer works, but there are lots of refinements, as you know after flying it." He turned to Clambake. "You're a hot pilot. What happens in a real plane when your carburetor ices up?"

"You lose power on the engine," Clambake said.

Mr. Sperry nodded. "That's right. Your brake horsepower goes down. Your thrust decreases. Now, if you want to maintain altitude, you haul back on the yoke. You increase your angle of attack. What happens to your airspeed? It drops. If you decide to keep your airspeed, instead, what happens? You shove the yoke forward and decrease your angle of attack—your rate of climb goes down. That's what goes on here, essentially. All the machine does is to continually solve the problem of flight—just what an airplane does."

Mr. Sperry paused.

"And brother, it works. Suppose they want to send you to Newfoundland with a full load of bombs and an overload of crewmen. Let's say you've never flown a *Privateer* under those conditions. You expect to fly through a cold front on the way, and you want to see how the plane will fly. Maybe you want to see if your weight and balance computations are correct, or if your loading plan is safe. What can you do? You can come down here and we'll set one dial and duplicate the load you intend putting on the plane. You climb in the Trainer and take off. Without ever actually leaving the ground, you find out how the plane will feel with that particular distribution of weight, in rough air or under icing conditions or anything you want. If your computations were wrong—if your center of gravity would have been too far aft, for instance, the Trainer will spin in. A hell of a lot better than finding it out the hard way."

Clambake gulped and nodded. We walked back to the desk flanked by instrument panels.

"The Trainer Operator sits here. He has

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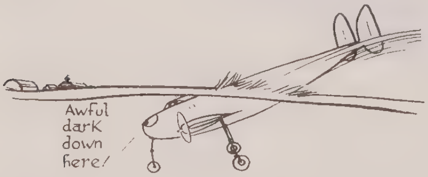
Dilbert

(*Continued from page 35*)

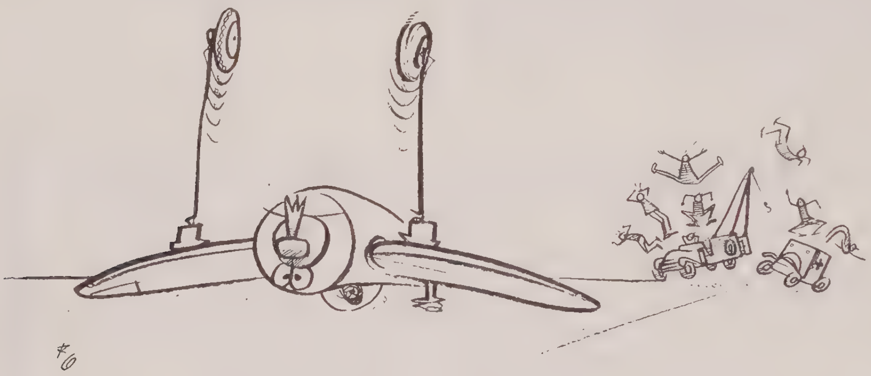
strain was so great that he *thought* something was wrong, and he would not be able to become airborne in the remaining 800 feet.

"When the pilot applied brakes under these conditions, the extra strain on the nose gear became so excessive that it collapsed."



But Sure—Dilbert was so intent on his landing approach that he never once looked at the tower. One glance would have sufficed to show him the red searchlight vigorously being blinked in his direction.

His radio must have been working, for he had just reported in and received landing clearance. So he must have heard the frantic attempts of the tower operator to let him know that his wheels were not down. Maybe he had another thought on his one-track mind which set up a brain block and made it impossible for this warning to get through and register. Or maybe he thought the operator was referring to two other guys. Anyway, he landed wheels-up. What's more, he slithered off the runway and turned over.



Something must have clicked in Dilbert's brain about then, or maybe the warning message just got through, for when the crash truck and rescue crew dashed up, they were amazed to see the landing gear slowly and laboriously being cranked *up* to the "down-and-locked" position.

Use Best Tank—Dilbert *thought* he had plenty of gasoline in the right main tank, so did not bother to check the quantity gage when he prepared to land during a X-C flight. About 400 yards short of the runway, the engine cut out and he had to put her down in an intervening lake. Luckily, he could swim.

After salvage, it was found that the right main tank was dry. Ample fuel remained in the other tanks. Of course, Dilbert often had been told, "Check your gas before coming down to land. Always use your best tank for landings, take-offs and other low-altitude flying." Maybe he didn't know that his "best" tank in a case like this is the one with some gas in it.

After A Forced Landing—Anybody can have a forced landing. But when a guy is forced down with engine trouble and then takes off without definitely locating and correcting the trouble, that guy is left holding the bag on any subsequent forced landing.

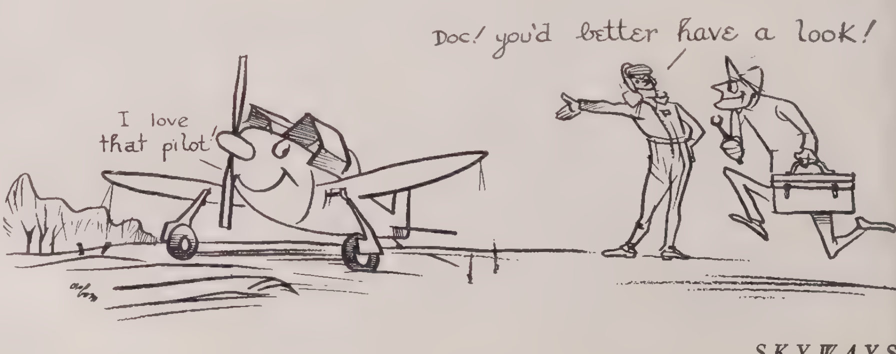
You'd be surprised at the number of such bag holders, and what Sad Sacks some of them are, because these second landings are often fiascos. The reason is, of course, that the first engine failures occur at sufficient altitude to enable the pilots to select suitable landing areas, while the second ones usually occur immediately after subsequent take-off, at altitudes too low to do anything but sit there and take it.

A typical case goes something like this: Initial engine failure occurred at 3500 feet. Pilot picked out cow pasture and made successful forced landing. Engine started readily and run-up proved successful, whereupon the pilot immediately *assumed* that cause of failure had cleared up; that it probably had been due to "temporary fuel stoppage." So he took off and when the engine failed again, he headed for the tall timber.

Get this straight: Few engine difficulties disappear of their own accord, after an initial failure or loss of power. Among those which may disappear, or be corrected by weather conditions or operating technique, are: icing, wet ignition, fouled plugs, and failures due to excessive cooling in closed-throttle glides. Just because an engine starts and turns up satisfactorily after a forced landing is not proof, however, that failure was due to one of the above causes.

Your "temporary fuel stoppage" may not reappear in the ground run-up, but changes in the attitude of your plane may send the sediment back into a position in the fuel system to cause a second stoppage. A chafed ignition wire also can give all the symptoms of an interruption of fuel supply, and yet not reappear when the engine is re-started and warmed up. Here again, vibration and change of attitude may cause a repetition of the failure subsequent to take-off.

Make it a cardinal rule not to take-off after a forced landing due to powerplant difficulties unless you locate and eliminate the cause, or are *positive* that the conditions leading to the initial failure can be corrected through operating technique. If in doubt of your ability properly to analyze the difficulty, it is imperative that you obtain the services of a competent engine mechanic. The mech's bill will be considerably cheaper than the cost of a new airplane.



Hell in the Cockpit

(*Continued from page 55*)

duplicate gages for every instrument in the cockpit. He can ice up your wings or give you air rougher than any you'll encounter in a hurricane. He can disable an engine, pull a circuit breaker on you, run you out of gas, give you carbon monoxide in the cockpit, simulate the change in balance caused by a crew member walking aft, give you a runaway prop—anything that can happen to you in flight, he can simulate here, except maybe the pilot's hangover." He pointed to a panel studded with lights.

"This board shows how quickly you react. Suppose the Operator pulls a prop circuit breaker on you. You fumble around the cockpit and finally find the breaker and reset it. A light flashes on out here. The Operator records the time it took you to find the switch. No argument there—he causes the emergency, you take corrective action, and if your reactions are slow, you'd better have a cockpit drill before your next flight in a real *Privateer*."

Mr. Sperry studied a sheet of paper on the desk. "Looks like you could use a little cockpit drill, Lieutenant, but I've seen worse."

He paused. "Of course, we have the regular set-up for working range problems—a crab that travels across a chart of the range, and shows your track over the ground."

He pointed to another desk. "That's the radio desk where the messages from your radio operator are received. At the same time that we're giving you the works we pull emergencies on your radio operator."

"How much did you say this thing cost?" asked Clambake.

"About half a million bucks."

Clambake whistled. Mr. Sperry looked at him quizzically:

"How much do you figure it costs to fly a *Privateer*, in gasoline alone?"

"Sixty, seventy dollars an hour. Maybe more."

"Well, it costs about a dollar an hour to supply power for this. I guess a *Privateer* costs about half a million dollars. If because of this training we save one *Privateer*, the installation has paid for itself. That's in dollars and cents—then there's the little matter of human life . . ."

Clambake nodded vehemently. "Yeah. Yeah, I second that . . ."

"We think that we've duplicated the feel of the *Privateer*—in fact, pilots have been coming out of that Trainer looking as if they'd been scared half to death." He looked at me closely. "As a matter of fact, you look kind of pale yourself."

"No," I lied. "No, it didn't fool me for a minute . . ."

Clambake and I left the Trainer Room and stepped out into the crisp Maryland sunshine. In the back of my mind was a shadow; I remembered the fumbling in the cockpit—fumbling that in the air could have bought us our own little plots of land, three feet deep and six feet long. I turned to Clambake.

"Say, have you seen that Pilot's Handbook around lately?"

"Yeah. Why?"

"You know, I think I'll kind of look through that thing again."

Clambake nodded.

"You know," he said slowly. "I think I will too . . ."

Overload Damage

(*Continued from page 29*)

a bit of clear thinking. It is evident that a shock load is liable to cause more damage than the same load applied gradually. It is evident also that if the part receiving the load can cushion its effect, damage will be less extensive.

Dan Kirby, pilot for a southern California aerial mapping and survey outfit, learned that detection of damage caused by an overload demands more than casual inspection. Dan was forced down by engine failure on the Mohave Desert some 30 miles from the nearest town. The terrain wasn't too bad—some brush and a rock here and there.

Dan managed to miss all but one rock. That one hooked his left landing gear, spun the plane part way around, and buried the dead prop in a clump of chaparral.

The tire didn't blow. The landing gear seemed unaffected. The only apparent damage was a few scratches on the prop blades caused by the thorny chaparral. Dan tugged the airplane out of the brush, tinkered the engine to life, and took off again. He merely mentioned on his daily flight report that he had been forced down by a clogged fuel line.

Six weeks and 50 landings later, the left gear strut buckled during a crosswind landing. The plane ground looped and nosed over. Dan hadn't corrected his crosswind glide quick enough, and the gear had struck the ground with a lot of side shear.

But that single shear load wouldn't have buckled a sound strut. That particular gear had withstood much greater shear loads in both static and dynamic tests. Subsequent examination showed rust on part of the fractured weld bead holding the shock-cord anchor eyelet in place. There were even bits of rock dust still clinging to the rusty surface.

That Mohave rock hadn't connected with the tire which would have cushioned the blow. It had connected with the welded eyelet with enough shock force to start a weld fracture. The shear forces of the crosswind landing had finished the evil work. Now Dan demands full and complete inspection of his airplane everytime he suspects it has been subjected to an overload.

The careful pilot will avoid overloads when he can, but avoidance is not always possible. Overloads must be considered a normal possibility and countered by thorough inspection. The degree of inspection required will depend on the magnitude of the overload and how and where it is applied. Sometimes visual inspection and checking with ordinary tools will suffice. At other times it will be necessary to remove suspected parts and have them inspected magnetically or by X-ray.

This implies that only a licensed mechanic is capable of making the inspection. In some cases this is true. But in all cases it is up to the pilot to determine when an overload has occurred and when inspection for overload damage is necessary. To do this, he must appreciate the danger involved, and be able to analyze, at least superficially, the effect of the overload on various parts of the airplane. He must be able to trace the overload from the part or parts receiving the initial load through various structural members to more distant portions of the airframe or flight surfaces.

Rough landings are one of the most common operational factors leading to overloads. Flying in to the ground, heavy porpoising, a rough landing strip, a small ditch or depression, or striking an object on the runway may induce a load on the airplane exceeding the cushioning ability of the shock absorbers. Exceeding operational limitations, gusty flight conditions, and stunting are other operational procedures that may lead to overloading.

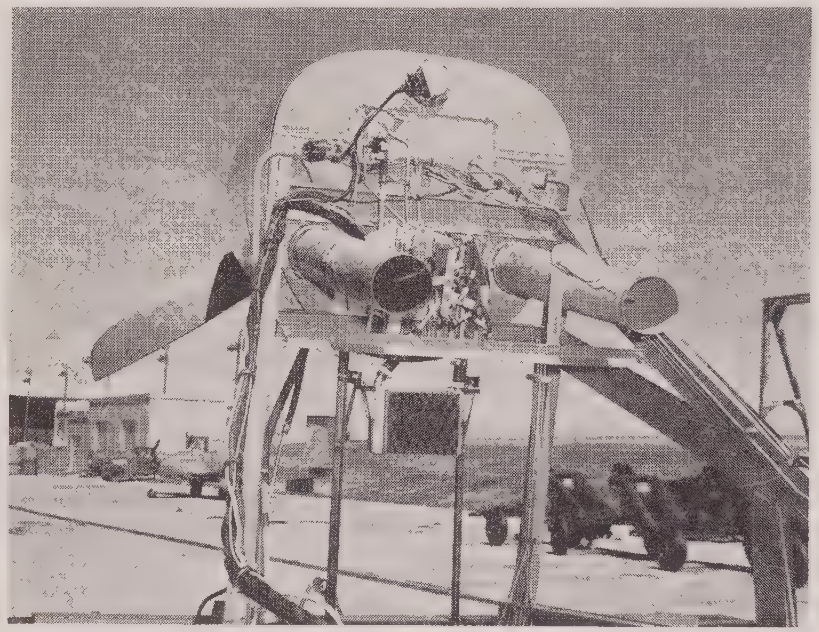
Rough ground handling may strain, bend, loosen or break various components. Towing over rough ground, hooking a wing, the landing gear or the tail skid while towing can cause a lot of damage. Pushing on the wrong part of the airplane while moving it, or stepping on other than marked walkway surfaces may bend or strain various parts. The effects of a strong wind on a tied-down airplane, or airport visitors clambering over the airplane are overload possibilities over which the pilot has no direct control.

Difficulty of detecting overload damage diminishes in direct proportion to the extent of the damage. It is easy to see a badly bent or broken part. It is much harder to detect a small crack, a slight misalignment or slightly loosened rivets. Strains that have reached the point of failure can be detected only by accurate measurement to determine distortion of the part. Cracks may be almost microscopic in size, yet offer an excellent bed for subsequent stress concentrations.

Another difficulty encountered is tracing the path of the overload through the airframe. A shock load on a strong member may not injure it, but a lighter member to which the load is transmitted may be bent or broken. Thus the tire, wheel and landing gear strut may not be affected by striking a sharp bump, but the attachment mounting of the gear on the airframe or a part of the airframe itself may be injured by the blow.

The wings below flying speed and the engine mount both have heavy overhang moments that are greatly amplified by a hard

(*Continued on page 64*)



New Lycoming for New Planes

Lycoming has long been a noteworthy name in the field of aircraft engines. Newest Lycoming is an improved version of the six-cylinder GO-435 series geared engine, horizontally opposed. Recently approved by the Civil Aeronautics Administration and now in production at Lycoming's Williamsport, Pennsylvania, plant, the new engine will power several new airplanes being produced by major manufacturers. The six-cylinder Lycoming will we used in the Beechcraft *Twin-Bonanza* and also in the new *Super Navion* which is scheduled for production by Ryan Aeronautical early in 1950. The geared engine offers three major advantages over direct-drive models: increased efficiency of the propeller, increased power and efficiency of the engine, and reduced noise level of the prop. The take-off horsepower of the GO-435 series is 260; take-off rpm, 3400; and rated horsepower, 240; rated rpm, 3,000. The Lycoming GO-435 shown in the above photograph is mounted on a test stand at Beech Aircraft Corporation.

Lightplane Mayday—GCA

(*Continued from page 42*)

questions and give directions somewhat similar to the following:

"What is your present heading, altitude, aircraft type and fuel aboard in hours?"

"Tune in ——— radio range station (frequency and identification code will be supplied). Climb, descend or maintain 2,000 feet."

"When over the cone turn left (or right), heading: ——— degrees, descend to altitude 1,500 feet and call GCA for further instructions. This will be your ——— leg."

"If no transmissions are received for a three-minute period, home on the ——— radio range station at 2,000 feet and contact base tower or base radio (frequencies will be given) for further instructions."

"Read back all headings and altitudes. All turns standard rate. Acknowledge all other transmissions."

"Weather at ——— AFB is as follows: (Ceiling, visibility, wind direction and velocity, altimeter setting)." When landings are made downwind, pilot will be advised of wind directions and velocity. Usually landings downwind with winds in excess of 10 knots are made at the pilot's discretion.

"We have you in positive radar contact ——— miles ——— (direction) from the field on your ——— leg. Traffic at field is left (or right) hand, landing runway is ———. Runway is ——— feet long, ——— feet wide. Field elevation is ——— feet, runway condition is (snow, ice, water, etc.)."

"Turn left (or right) heading: ———, altitude: ——— feet. This will be downwind leg."

"Check your gyro."

"What will be your airspeed on base and final legs?"

"Perform your initial cockpit check, wheels down and locked."

"Stand by to turn on base leg."

"Turn left (or right), heading: ——— degrees, descend to and maintain 1,000 feet. This will be base leg."

"Perform landing cockpit check, wheels down and locked."

"Check gyro and do not reset for remainder of the approach."

"Prepare for left (or right) turn, heading: ——— degrees, altitude 1,000 feet. This is your final approach."

At his point, usually about five miles from the field, the final director takes over. "This is your final controller, how do you hear me?"

"If no transmissions are received for a five-second period, pull up immediately to 2,000 feet, home on the ——— radio range station and contact base tower or base radio for further instructions. Acknowledge."

"Do not acknowledge further instructions."

After the last direction which is usually given just before the controller guides the plane into the glide path, the controller then gives directions for correcting the rate of descent and azimuth (in line with the runway). The azimuth direction is in degrees, based on the last gyro setting while the glide-path instruction may be in feet high or low and the controller may call for an increase or decrease in descending speed. "You are below the glide path, decrease your rate of descent. You are on the glide path, your azimuth is good. You are now three miles from touchdown, tower has cleared you for landing. Turn left one degree, heading should be 300, you are on the glide path, your azimuth is good."

The directions will be given up to a point at the end of the runway from which the pilot makes the landing straight ahead on his own. In case of a missed approach, the pilot will be told to pull up and climb to a given heading and altitude. He will also be told the reason for the miss, whether too high or too low, too far left or right on the final.

When an aircraft reports it is low on fuel, the traffic director usually rates it in on the shortest possible pattern and the final controller gives it priority for a safe approach at shorter intervals. When an aircraft is lost, he is usually brought to base GCA control by a D/F homer station and then a normal run is made as described.

It is obvious that safe GCA landings depend on a pilot's being able to hold an airplane on a steady heading and a steady rate of descent. He also must place all his confidence on the controller's judgment and not allow his own ideas of what's a right or wrong course to cause a position change. Accidents under GCA control have been due to a pilot over-ruling the controller's direction, causing him to leave control too soon, thus missing a landing. In one instance, a military pilot was positive he saw the runway and so broke his glide path. The result was a crash short of the runway. Unless the indication is positive and not a trick of vision, the pilot should never overrule the controller and he should always inform the controller when he is leaving the directed pattern and the reason.

As far as lightplane pilots are concerned, GCA is not insurance for pushing into IFR weather unless the plane is completely equipped and the pilot holds a valid instrument rating. GCA may bring an unlucky pilot out of the sky even if he has only minimum of radio equipment but the word is "may" not "will." Even though GCA can be an answer to an airman's prayerful "mayday" the wise pilot won't push his luck and depend on an aid that calls for equipment he doesn't have.

PICTURE CREDITS

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(Continued on page 62)

500 Miles Up!

(*Continued from page 49*)

As the altitude increases, the mean free path between particle collisions increases. The mechanism by which sound waves are propagated is one of longitudinal oscillations of particles, which collide with others and impart to them their directed energy. These particles, in turn, are set into longitudinal oscillation by the collision and impart to others the energy which they have received.

The sound waves are propagated at a speed which is of the same order as the mean particle speed. Consequently, when the particle mean free path approaches in magnitude the length of the sound wave being propagated, a considerable number of particles move from the region of compression to that of rarefaction (and vice versa) during one oscillation. Since there are differences in pressure and temperature between these regions, the effect of this particle motion is to equalize these temperatures and pressures. This process effectively dissipates the energy of the sound waves and causes it to be damped (attenuated). Thus, at higher altitudes, sounds of short wave lengths are damped in very short distances, whereas sounds having very long wave lengths are propagated to greater distances.

The method by which upper-atmospheric-temperature data are determined from explosions is based on the fact that sound waves, in common with all other types of wave motions, are reflected and or refracted in traveling from one medium to another. Thus a high-temperature region, such as the ozone layer, will reflect or refract sound waves, depending upon the angle of incidence of the wave with the layer. Sound waves originating from an explosion will travel upwards and be reflected back to the earth's surface or refracted to higher altitudes by the various temperature regions. This process causes zones of silence which are located between zones where the sound waves have been reflected back to the earth from the ozone layer. The reflected sound waves heard at great distances from the source of the explosion have been able to penetrate into the ionosphere and have been reflected back to the earth by the high-temperature regions.

Cloud formations are perhaps the most commonly visible characteristic of the atmosphere. Physicist W. J. Humphreys has identified at least 21 different cloud formations. The drawing on page 33 shows the distributions of the more important cloud formations with altitude. Cloud heights vary from the fog belt at sea level to the rare noctilucent (night-luminous) clouds at the 50-mile level. Most of the cloud formations occur below the 7-mile altitude of the tropopause, however. In connection with this fact, however, it should be noted that the altitude at which a given type of cloud formation may appear depends greatly upon the topography of the earth. For example, the lenticular cloud, which is shown in this figure at a nominal altitude of 2,000 feet, may be found, under suitable conditions, at altitudes greater than 40,000 feet.

The clouds are composed of condensed water vapor or ice crystals. They are formed whenever the atmosphere becomes saturated with water vapor. The existence of condensation nuclei, such as fine dust particles, smoke, and hygroscopic gases, accelerates cloud formation under suitable atmospheric conditions. There is evidence that under normal conditions the humidity in the stratosphere is low, and that the condensation nuclei, which are believed to originate from the earth, are practically non-existent.

The prevailing surface winds of the earth have been known since the time of the clipper ship. The vertical height of the earth's wind circulation pattern is believed to be restricted to the troposphere. However, a recent investigation indicates that this pattern may be only a small part of a larger, more complex system. From studies of noctilucent cloud and meteorite-trail movements, evidence has been found of extremely high velocities in the stratosphere.

Waviness of noctilucent clouds and measurements of total pressure in rocket ascents have given experimental evidence that there exists regions of extreme vertical winds—a tailwind going straight up!

Occupants of all vehicles which are to travel in the stratosphere and outer atmosphere must be provided with auxiliary oxygen and enclosed within pressurized compartments. The human body, although able to withstand some variations in temperature- and pressure-environment, nonetheless has certain limitations. The specialized branch of medicine, aviation or aero-medicine, has already determined many of these limitations and identified afflications associated with exposure to extreme environments. For example, dissolved gases and water vapor inside the body expand and cause the skin to swell like a balloon at absolute pressures of about 69 mm of Hg (pressure altitudes of 55,000 feet). Also, disregarding this expansion of gases and water vapor, the blood is known to boil at normal body temperature at an absolute pressure of 47 mm of Hg (pressure altitude of 63,000 feet). When man is exposed to low pressures, his speech, sight, hearing, pain-sensitivity, and mental reactions are all influenced. The extent to which they are influenced depends on the altitude and duration of exposure.

At about two miles man would begin to feel heavy and dull-witted, and at four miles he'd probably lapse into unconsciousness. If he had oxygen equipment, he could hold out to about six miles above the earth, but he'd lose his hearing sense, wouldn't be able to whistle and his voice would lose clarity. He'd get the 'bends.' At over eight miles even with oxygen he couldn't live long. At 11 miles he'd swell up like a balloon, and at 13 his blood would boil. Although man has ascended to altitudes greater than 70,000 feet, he has done so only in pressurized compartments. The dangers involved in pressurization system failure or enforced "bail-out" are obvious. Chart on page 33 shows the effect of atmospheric characteristics on the human body. These effects are limited to the lower atmosphere. At extremely high altitudes, even in a pressurized and air-conditioned environment, consideration must be given to other effects such as the influence of extreme ultra-violet solar radiation, cosmic rays, and meteors.

Certainly, exploration of the earth's atmosphere is today one of the most challenging fields of scientific endeavor. It is important that all workers in the aircraft and missile fields keep abreast of new information concerning the atmosphere in order to interpret its influence upon their designs.

Dollars And Sense

(*Continued from page 48*)

Of the more than 500 postwar Twin Beeches, at least 450 are now flying the executive airways in this country. However, there may be another 175 or so of prewar or converted Beechcraft 18 type aircraft purchased from War Surplus and presently used by business firms. These include the C-45 light transport and the AT-7 or AT-11 bomber crew trainers. The fixed charges on such aircraft would be considerably less, owing to the much smaller investment, and might easily run less than 50 per cent of the total annual cost, instead of 60 per cent as in the case of a new aircraft.

Here are the figures on a Twin Beech converted from the military. Initial cost, $20,000 to $22,000; cost of conversion, including new radio equipment, $8,000 to $10,000; total cost $30,000. Assume 600 hours utilization per year. Pilot, $6,000; hangar, $1500 (both same as new aircraft); insurance ($25,000 value), $2300; and depreciation, $4200. Total fixed charges, $14,000, or $23 per flight-hour. Operating costs same as for new aircraft, or $16,000 ($27 per flight hour). Total cost per year, $30,000, or $50 per flight-hour. Cost per airplane-hour, 27.3 cents; per passenger-mile (4) about 7 cents, or 9 cents if three passengers.

The Beechcraft 18 (roughly 625 in company operation) and Lockheed 12 (some 25 flying in business use) may be regarded as Class AAA league in the executive-transport field. The $11,500 to $15,000 *Navion*, *Bonanza* and Cessna 190/195 would then rank as Class AA—about 3300 of these are in operation as executive planes. A total of 2700 less expensive four-place ships in $8,000 bracket, such as the Stinson 150 and 165 *Voyager* and Cessna 170, plus a fair number of older Howards, etc., would be Class A. This makes up the total of about 6,000 single-engine executive planes mentioned earlier.

From the standpoint of cost, capacity, luxury of appointments, etc., the major league stuff includes the Douglas DC-3C, Lockheed *Lodestar* and Grumann *Mallard*. Added to these should be such converted bombers as the Douglas B-23 and A-26, North American B-25 and Lockheed PV-1 *Ventura;* also a few four-engine conversions.

Flying the U.S. executive airways there are now about 200 converted *Lodestars* (C-60), 150 DC-3C's (C-47), 50 *Mallards*, and about 50 of the converted bombers, C-54's, etc. This makes a total of about 450 of the big ships. Add to this about 650 Twin Beechs, Lockheed 12's and possibly up to 900 twin-Cessna T-50 *Bobcats* (including converted UC-78's), and we reach the round figure of 2,000 multi-engine executive aircraft previously referred to.

The per-hour costs of these larger airplanes may run anywhere from $125 to $200 or more, depending on original cost ($75,000 to $150,000), extent of annual utilization (not so easy to build this up with the larger expensive equipment), insurance coverage, method of figuring depreciation, etc. With 450 hours utilization (average 35 to 40 hours per month), the resulting rate per passenger mile may run from 20 to 40 cents or more, depending on the number of passengers carried, in addition to the above factors.

The increasing number of large corporations using this type of equipment indicates that these figures are not regarded as out of line. Such operations can be made relatively more "economical" by means of a well-run transportation department set-up which plans for maximum utilization of the aircraft by the most departments and the greatest number of passengers.

Coming back to the figures for the smaller twins and single-engine executive types, attention is called to the great drop in cost per flight-hour when annual utilization is run up to *900 hours* instead of 600 (*see chart*). From this it is easy to see how company planes *can* be economical.

Break-Down of Costs of Three Typical Executive Aircraft at 600 Hours' Utilization Per Year

	"A" New Twin Beech	"B" Used Twin Beech	"C" *Bonanza* or *Navion*
Initial cost, airplane & equipment	$75,000	$30,000	$12,000
Annual cost, 600 hours' use	40,000	30,000	14,000
Fixed charges:			
Pilot's salary	6,000	6,000	5,200
Hangar rent	1,500	1,500	600
Insurance	4,200	2,300	900
Depreciation	12,300	4,200	1,900
Total fixed charges	24,000	14,000	8,600
Per flight-hour	40	23	14
Direct operating costs:			
Gasoline and oil	10.200	10.200	2,400
Maintenance	4,200	4,200	1,800
Landing, and itinerant storage fees, pilot's expenses, etc.	1,600	1,600	1,200
Total direct operating costs	16,000	16.000	5,400
Per flight-hour	27	27	9
Total cost per year	40.000	30,000	14,000
Total cost per flight-hour	67	50	23
Cost per airplane-mile	.363	.273	.155
Cost per passenger-mile	(3) .121	(3) .09	(2) .078
Cost per passenger-mile	(4) .091	(4) .07	(3) .05

Overload Damage

(*Continued from page 58*)

landing. The engine mount especially requires a careful inspection each time a hard landing occurs. Most engine mounts are of welded tubular construction, and each weld must be carefully checked for cracks. The lower longitudinal tubes of the mount receive a tremendous compression load when the airplane smacks down hard, and each should be inspected for bending, bowing and cracks. The anchor or fuselage attachment bolts and fittings on each wing should be inspected, along with the bolts and attachment fittings on each end of the cantilever braces.

Inspection for possible damage caused by other types of overloads should proceed along the same logical course. Inspect the part that receives the initial load, then proceed to attachment fittings and bolts, and beyond to the next structural component. Carry on this same thorough inspection technique until you are firmly convinced you are beyond any area of possible damage. All parts with overhang moments or directional moments should be checked when sudden acceleration or deceleration affects this moment.

It is useless to proceed blindly, just looking for something wrong. Definite techniques must be used, and clues that indicate damage must be kept in mind. First, examine all parts for visible breakage or bending, and all fittings for security. Pay attention to every weld. Clean away all dirt and look for cracks along the edge of the weld bead and through the bead itself.

Straight parts and sections may be checked for bends or bows with a straight-edge (a square, a straight slat, or a fine wire stretched tight will suffice). Plumb bobs may be used for checking verticle centers. If a rigging diagram is available, point-to-point distance checks will reveal intervening structural or part distortion.

When a wrinkle in a skin or diaphragm section is discovered, check all attachment rivets for possible shear or looseness. Rivets will sometimes shear, leaving the head intact. When this happens, it is usually possible to insert a feeler gage in the lap joint. If the rivets are loose, look carefully for cracks emanating from the rivet hole. If cracks are visible, drill a small hole (1/16 to 1/8 inch in diameter) at the end to prevent further cracking.

Large wrinkles or buckles in metal skin sections are almost a certain clue to internal failure. Even if the wrinkle can be ironed out, inspect all underlying and attached structures and parts thoroughly. Certain skin sections may have been stretched just enough to "oil can" in and out when pressed. Do not ignore this warning. Check all surrounding rivets for tightness and inspect the underlying structure.

Exterior finish will often furnish a clue leading to discovery of overload damage. If the coating is cracked or flaked, it may have been caused by stretching or distortion of the metal over which it is applied. Tiny flakes of loose paint around rivet heads may indicate loose rivets. Webbing straps and fabric that becomes suddenly tight or overly loose following an overload may be a clue to distortion. The same applies to suddenly taut or sagging wires, cables, and rigid and flexible hydraulic lines.

Cracked transparent plastic inserts and cracked flush-type light lenses that did not receive a direct blow indicate that severe distortion, either momentary or permanent, occurred. When this happens, surrounding structures warrant a thorough going over.

There is a better than even chance that you won't find anything wrong after an overload. Modern airplanes are built to take a lot of abuse and come through unscathed. But don't drop your guard and hide behind this extra measure of safety. Instead, add your own intelligence to that margin.

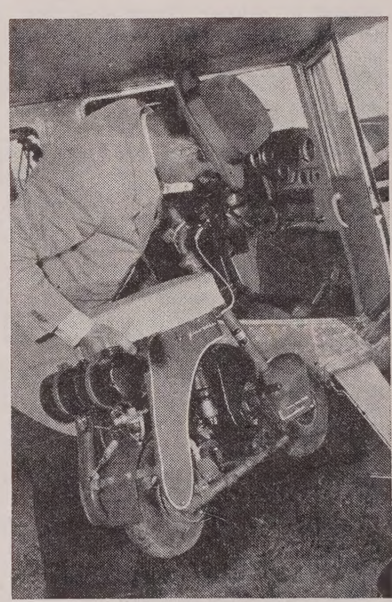
If you can't find anything wrong after you know the airplane has been subjected to an overload, don't relax until after you've made a test flight. Check the action of the controls against their former action. Check response to the controls. Note any decrease or increase in vibration at all engine speeds on the ground and in the air. Check your landing speed and the indicated airspeed at take-off. Any variation in any of these functions indicate that a change has occured. Don't rest until you have determined what and why.

When damage is discovered, the pilot will have to use his own judgment regarding its correction. It is up to him to determine whether or not a licensed mechanic must be called in. Common sense is the best dictator under these conditions. CAA regulations limit what a pilot can do in the way of repairing his own airplane, and are a good guide when in doubt.

A logical and central course to follow is to avoid overloads when possible, but when they do occur, make certain whether or not damage has resulted regardless of the steps that must be taken. When a question exists, seek the safest answer. Safety and gravity are the major opposing forces in aviation. Line up with safety on your side.

ADABASHIAN'S six-foot one-inch frame really envelopes the handy scooter

Flying Salesman



PILOT-SALESMAN loads his Doodle-Bug scooter into his two-place Cessna

Richard Adabashian is a salesman for a candy company . . . and a salesman who has learned how to turn his airplane into profit. Pilot Adabashian owns a Cessna, and next in the importance to him is the tiny scooter Adabashian takes along with him in the plane. Thanks to that scooter, he has his own "free" transportation from airfield into town. Before the candy salesman owned his own airplane, he traveled by car and train, and managed 12 or 14 calls a day. With his airplane-scooter combination, he averages 24 calls a day, and what's even better—he's home with his family almost every night.

The "Doodle-Bug," runs 100 miles on a gallon of gasoline, and the Cessna averages out about 23 flying miles per gallon of gas. The salesman's formula of operation is to fly to a town, land his Cessna in any suitable field, ride his scooter into town, back out again . . . then wing away to the next stop. The scooter cost $99, is powered by 1½-hp engine.

Oliver K. Whiting

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